DecisionSpace® Unconventionals

MANAGE THE LIFECYCLE OF YOUR UNCONVENTIONAL RESOURCES
TO DRIVE OPTIMAL RESERVOIR PERFORMANCE
OVERVIEW

DecisionSpace® Unconventionals, the industry’s first comprehensive suite of geoscience, reservoir, drilling, production, and economics applications, is delivered on a single platform, and optimized for managing the lifecycle of unconventional resources. Unconventionals continue to be a global strategic resource actively exploited by E&P companies facing common shale productivity challenges that require:

» Production optimization and tight cost control to exploit economically
» Drilling long horizontal wells and fracture stimulation to produce economically
» Modeling of natural fractures
» Sophisticated statistical analytics to target productive zones or “sweet spots”
» Multi-year drilling programs to sustain production volumes to mitigate rapid decline rates
» Cross-disciplinary contributions and data sharing instead of traditional siloed work practices

To overcome these complex challenges, companies need a robust solution that can deliver an integrated approach with seamless business processes and accelerated decision making capabilities. The need has never been more compelling for companies to incorporate new technology that will help them improve performance, deliver faster results, and reduce risk.

To succeed in unconventionals, companies require advances in technical problem-solving prior to drilling, completion, and stimulation. With DecisionSpace® Unconventionals, companies can take a holistic approach to optimize shale field exploitation and maximize production efficiency. DecisionSpace® Unconventionals reduces uncertainty through improved characterization of the reservoir, leading to better decisions on wells and completions, which in turn lead to more reliable production forecasts. Landmark’s solution makes it possible with a suite of applications specifically designed to help:

» Improve cost per BOE
» Enhance frac performance
» Increase recovery
» Reduce risk and uncertainty
**BENEFITS**

Insights from Landmark’s DecisionSpace® Unconventionals solution collectively help to optimize well placement and stimulation strategies in unconventionals.

**Unique purpose-built capabilities:**

» **Sweet spot identification**
   Selecting the best location in which to place an unconventional well is a complex problem involving the interplay of petrophysical, geological, geomechanical, and chemical properties. Asset teams need to be able to quickly identify the optimal part of the reservoir to drill and frac. The ability to generate super-variables from earth models using multivariate analysis facilitates sweet spot identification.

» **Well location optimization**
   Well count is often the most important parameter in economic performance of shale reservoirs. DecisionSpace® Unconventionals allows users to predict the performance of alternative well location and frac programs in order to maximize economic performance.

» **Fracture Productivity Prediction**
   In unconventional reservoirs, an understanding of the interaction between the natural fractures that exist in the reservoir with the induced fractures generated by the fracing process is key to predicting production performance. DecisionSpace® Unconventionals functionality includes the modeling of natural fractures and the ability to simulate fluid flow through the reservoir.

*Figure 1* » Landmark’s unconventionals management process to drive optimal performance with unique purpose-built capabilities
What makes DecisionSpace® Unconventionals unique?

» An end-to-end geoscience, reservoir and engineering solution purpose-designed for shale plays spanning the full E&P lifecycle and delivered on a single platform

» Innovative unstructured gridding is applied to natural and induced fractures resulting in improved well and reservoir modeling for the better prediction of technical and economic performance

» A continuous, iterative, and dynamically updateable model that supports E&P business processes to reduce decision-making latency and increase team collaboration

FEATURES

DecisionSpace® Unconventionals is applicable to all geoscientists and engineers interested in improving performance in shale and other unconventional plays, particularly those involved in subsurface and well-related disciplines.

With the DecisionSpace® Unconventionals Solution suite, all pertinent data is accessible and applications are co-located, allowing asset teams to easily collaborate across functions from basic data search and analysis to advanced workflows such as complex fracture network characterization. The easy-to-use solution incorporates modeling capabilities specifically targeted at unconventional assets including:

» Natural fracture network modeling
» Unstructured gridding for complex geometries including fractures
» Advanced multivariate statistical analysis for sweet spot identification
» Rigorous simulation of production performance from natural and induced fractures
» Advanced petrophysical capabilities
» Semi-automated fault tracking
» Enhanced geosteering
» Link to basin modeling application for organic content and maturity
» Multi-Azimuthal pre-stack analysis to determine fracture orientation and improve well placement

FEATURE HIGHLIGHTS

Multivariate Data Analysis

DecisionSpace® Unconventionals contains Big Data Analytics tools widely successful for solving complex problems in other industries, such as pharmaceutical, medical and the stock market. Analytical tools, like Multivariate Data Analysis, help geoscientists and engineers understand sweet spots via next generation approaches. It allows you to assess and
classify data, reduce the number of variables to create new attributes that can honor all the input data, and identify the most relevant data to make more reliable predictions.

With Multivariate Data Analysis:
» Analyze multiple variables
» Enhance sweet spot identification
» Optimize well placement

Benefits:
» Easily and effectively combine multiple independent variables to create a “super variable” representing a key indicator of interest, such as reservoir “quality index” through multivariate data analysis methods
» Condense key information from the input data to help identify reservoir sweet spots
» Visualize results in maps, 3D grids or cross-sections to aid the asset team in planning their next wells

Method Benefits:
» Correlation Matrix Analysis helps identify the variables that have the most impact on results
» Discriminant Function Analysis helps you classify input data into meaningful groups
» Classification and Regression Tree (CART) helps you construct predictive models from the data for example, optimal number of frac stages, horizontal section length, stimulation interval, and fluid amounts
» Cluster Analysis allows you to put variables into groups or clusters, so objects in each cluster have similar properties
» Principle Component Analysis (PCA) and Factor Analysis are variable reduction techniques that can help produce a super variable or quality index depicting for example, good shale quality versus bad shale quality

DecisionSpace® Natural Fracture Network

Natural fracture network characterization is vital to understand the multiple fracture systems that exist in the reservoir: their strike, dip, and distribution. This helps to determine the best strategy to induce hydraulic fractures, effectively stimulate the natural fractures and establish flow path.

DecisionSpace® Natural Fracture Network utilizes image log interpretation data for natural fracture modeling. To make best use of available data, secondary data such as seismic attributes can also guide fracture distribution.

Benefits:
» 3D modeling of natural fractures
» Honors observed data and the statistics
» Helps optimize well orientation and placement
» Simultaneously incorporates both hard and soft data
» Supports curved fracture planes
» Directly integrates with DecisionSpace® Fracture Productivity workflows
**DecisionSpace® Fracture Productivity**
Helps predict well and asset productivity in the presence of hydraulic and natural fractures by using an automatically-generated unstructured simulation grid, which is used as the basis for high-fidelity prediction of reservoir performance. DecisionSpace® Fracture Productivity is designed for use by engineers that are not specialists in simulation.

**Benefits:**
» Models well and pad performance over the life of the asset
» Customized simulation product with easy-to-use interface
» Unstructured gridding for very fine detail around fractures
» Drives-up asset productivity by enabling workflows that support:
  » Estimate optimum well spacing – when used as a field planning tool
  » Completion optimization – by quantifying the effect of changing fracture treatment parameters on well productivity
  » Modeling complex processes such as miscible injection, diffusion transport, choke management, and well scheduling
» Adapts to your problem by incorporating:
  » 3D earth model
  » Auto-generated 2.5D unstructured grid when 3D earth model unavailable

**Figure 6** » Image shows an engineering unstructured grid created using DecisionSpace® Fracture Productivity.

**Figure 7** » DecisionSpace® Natural Fracture Network and DecisionSpace® Fracture Productivity integration results showing unstructured grid of natural fracture network model with depletion in natural fractures that are connected to the well.

**Figure 8** » Image depicts the consistent representation of 3D natural fractures and hydraulic fractures in the simulation grid with DecisionSpace® Fracture Productivity.
The major sequences across the DecisionSpace® Unconventionals solution workflow provide standalone value, but combined together the suite provides a step-change in unconventional software technology capabilities.

Landmark offers solutions to help you deliver on your business strategies. For questions or to contact your Landmark representative, visit us at www.landmark.solutions.