OVERVIEW

DecisionSpace® Geosciences 10ep delivers an end-to-end suite of geoscience, well planning, and geosteering solutions created to deliver one overriding concept: Collaboration by Design. DecisionSpace Geosciences 10ep is founded on building a single subsurface representation that enables all geoscientists to contribute to a shared understanding of the subsurface structure and properties.

Asset teams are challenged not only to locate and delineate increasingly complex reserves replacement opportunities, but also to find those reserves efficiently, economically and at the lowest risk. With at-the-wellhead prices in flux and many projects at the edge of economic viability, asset teams must create a higher quality portfolio of drillable prospects and development opportunities than previously required. This requires greater collaboration.

With DecisionSpace Geosciences 10ep, geoscientists and engineers can collaborate effectively and securely in real time using the industry’s only integrated geosciences suite built on a single platform. Whether the need is to span the exploration & appraisal, the reservoir management, or the well construction lifecycles, DecisionSpace Geosciences 10ep provides an unmatched application suite to interpret all oil and gas data, evaluate and prioritize prospects before drilling, and maximize the full recoverable potential of the reservoir during production.

DecisionSpace® Geosciences 10ep delivers a true interpretation environment with unprecedented integration across multi-domain workflows and data types.
DecisionSpace® Geosciences 10ep suite provides a complete geoscience reservoir characterization workflow across geologic and geophysical interpretation, mapping, and earth modeling for asset teams. Traditional geoscience interpretation tools, in combination with Landmark’s award-winning Dynamic Frameworks to Fill® software technology, enables a powerful workflow that delivers a step change in efficiency for structure and property mapping. Geoscientists can concurrently build a sealed structural framework as they interpret, adding the framework with facies and deterministic reservoir properties, and then create accurate maps in minutes. Manual, time-consuming tasks such as fault-polygon digitizing and surface regridding, normally tedious tasks that are normally necessary after interpretation revisions are relegated to past history. Updates dynamically populate through the model as new interpretations are done or as new data are added.

**BENEFITS**

**Complete Workflow**

DecisionSpace® Geosciences 10ep enables an uninterrupted geoscience workflow from geologic interpretation through geophysical interpretation and into earth modeling and well planning and geosteering which yield accurate structure and property maps and critical volumetric estimates.

**Accelerates Interpretation and Reduces Rework**

Traditional framework building and mapping tools require a series of depth conversion and gridding steps for faults, well picks, and seismic horizons that quickly get outdated as new seismic data is acquired and wells are drilled. With Dynamic Frameworks to Fill® workflows, each map is tied to the original interpretation and is updated as users interpret horizons and faults. This enables the interpreter to identify inconsistencies in the interpretation much earlier in the cycle. The benefit: higher confidence, reduced risk, and more time to assess the play.
Accurate Reservoir Characterization and Measurement of Uncertainty

The earth modeling workflow is optimized to promote integration, usability and science, from building geocellular models directly from a sealed structural framework, such as Dynamic FrameWorks to Fill® workflow, through intuitive facies and petrophysical modeling, to static volumetrics and uncertainty. The application combines an intuitive design, along with innovative facies control and advanced techniques like lithology proportion mapping and variogram analysis. Advanced geostatistical algorithms available natively in the application, including Pluri-Gaussian, Sequential Gaussian and Sequential Indicator, enhance the horsepower of this solution.

FEATURES

Enhanced User Experience

Significant usability enhancements are introduced that improve both consistency and efficiency in completing key workflows, reduce clicks, and mouse mileage. It now allows users to customize their tools and experience while expanding the concepts of perspectives.

Unified 1D/2D/3D Workspace

Interpretations in log, map, section, and cube views are dynamically linked. Geologic data can be interpreted in the context of seismic data and geophysical interpretations. Windows can be configured, docked, and undocked.

eLearning

Dynamic eLearning accelerates technology uptake by minimizing the cost and time required to learn new software. Includes updatable and customizable content, fast search, and links to iEnergy community, how-to tutorials and a video library.

E&P Search Workspace

Enables asset team members to find and access data across their enterprise and visualize in mapview and tabular form before adding to their session. Options include the ability to search all projects in the enterprise using DSIS or only their active project. Advanced output options include dynamic well lists, zone manager, point sets, shape files, and reports.

GIS Map

Create and layer spatial data on a map through use of ESRI’s ArcGIS runtime in a new integrated GIS view. GIS capabilities also provides cartographic context for search results from global data search function. Geo-reference capability provides a user-friendly method to cartographically reference to any raster file.

GIS Integration

Display geo-referenced images and ESRI shape files in the context of the interpretation. Any image that can be displayed can be used as a background for interpretation.
Dynamic Time-Depth Conversion
Geoscientists can dynamically switch between time and depth domains using a velocity model generated in DecisionSpace® or any externally created velocity stored in the database. This enables a new workflow where wells can be interpreted in depth and the seismic can be interpreted in time, and the framework can be created in either time or depth and updated without any manual depth conversion process.

Traditional Geologic Interpretation Tools
• Log correlation in section and 3D views
• Pick tops, faults, intervals, and lithology
• Hang tops on one or many surface picks
• Select and drag curves for quick correlation
• Raster log display
• Cross-sectioning along seismic, point-to-point, well-to-well, or along the wellbore
• True Stratigraphic Thickness (TST) and True Vertical Thickness (TVT) options
• Maps and bubble maps on production or point-set data
• Thematic mapping
  • Log signature posting
  • Stratigraphic column creation

Well Templates
Set up well templates with OpenWorks® data for log curves, production, pressure test, images and raster logs, synthetics, lithology, well intervals, perforations, casing, liner, or stratigraphic unit and attributes.

Well Display
Well-specific layouts enable user-defined display parameters for different well displays in the same view. The Display Property Editor enables user-defined display parameters that are specific to any object.

Log Calculator
Basic petrophysics tools for the geoscientist offer user control of curves for pay, lithology, and facies. Options include user-defined log calculations and an equation toolkit with standard petrophysical equations.

ZoneManager™ Software
ZoneManager™ software enables very efficient unit-based reservoir characterization workflows. Users can relate seismic, petrophysical, hydrocarbon production and any other ad hoc attributes for wells zones in the project, to understand and validate which critical parameters affect successful production.

Multivariate Analytics
Multiple advanced techniques for examining relationships among multiple variables at the same time. Used by E&P companies to find the relationship between the presence of oil and gas or economic production rates and multiple geologic and seismic attributes.
**Production Data Analysis**
DecisionSpace Geosciences 10ep software allows users to perform decline curve analysis, which generates a prediction of estimated ultimate recover on a well-by-well basis and predicts production life span based on economic cut offs. This information can be further analyzed using ZoneManager software.

**Dynamic Frameworks to Fill® Workflow**
A structural framework topology engine enables sealed framework construction for user interpretation. Using classic map-making principles, outlined in Tearpock and Bischke, input data is independently gridded in the context of individual fault-block domains, projected into the fault planes, and truncated. The software more accurately defines how fault and horizon boundaries relate to one another. High-resolution sealed frameworks can be built quickly using tops, seismic, and conformance technology. The shared framework is dynamically updated as interpretations of new data are made. Presentation-quality maps for all layers and properties become a byproduct of the sealed framework and can therefore be created in minutes without manual fault-polygon digitizing and regridding.

The Dynamic Frameworks to Fill workflow includes:
- Fault networking, unconformity trimming, and auto-generation of fault polygons
- Automatic integration of faults and unconformities
- Interactive horizon clean area and intersection editing
- Property mapping from interval and log data and use of framework to define intervals

*Dynamic Frameworks to Fill® technology creates a sealed structural framework while interpreting, updating automatically as new information is received or interpreted. This ensures the latest information is used by the entire asset team leading to more accurate volumetric calculations and better drilling decisions.*

**Conformance Mapping**
Implementation of this classic geologic concept uses top-down, conformable, or bottom-up conformance techniques to speed interpretation where data is poor or sparsely sampled. In this practical application of conformance mapping, the software leverages the shape of seismic surfaces to guide the mapping of well-top surfaces. Geoscientists can quickly build very high-resolution structural frameworks by combining the horizontal resolution of seismic horizons with the very high vertical resolution of well-log data.
**Interactive Horizontal Well-log Correlation**
The software facilitates interactive correlations between a predicted curve and real-time LWD measurements from the drilling well in the visual context of interpreted surfaces and seismic data. The interactive workflow can provide a better understanding of the stratigraphic position of the drilling well.

**Traditional Geophysical Interpretation Tools**
- Synthetic generation (Well tie workflow)
- Seismic volume attributes and data enhancement on 2D and 3D seismic
- Horizon and fault interpretation in section, map, and 3D views
- Horizon autotracking
- Velocity modeling and depth conversion
- Seismic horizon computations and attributes
- Prestack seismic visualization and interpretation
- Crossplot analysis for AVO and attribute analysis including

**Automated Fault Extraction**
Offers multiple fault tools to automatically interpret and study virtually all the faults in a seismic volume while also providing the ability to adjust and improve the results in an efficient way.

**Zmap Plus Mapping Plugin**
Provides an intuitive and spatially focused mapping tool powered by Zmap. Full input data analysis and filtering capabilities, advanced horizon merge options, smoothing, 2D volumetrics, and advanced map QC and surface shaping capabilities for workflows which require more interpretation by the geoscientist due to sparse data.

**3D Geoshaper Interpretation**
Geoshaper “freehand” interpretation tools offer a method for interpreting in the absence of seismic or well data. Unconstrained editing of points in cube view to use as shaping input for maps and frameworks.

**16 Bit Shared Memory and High Definition Color**
16bit shared memory volumes allow interpreters to load higher resolution data into shared memory. High Definition color allows the color map to represent the true resolution of the data and at the color fidelity supported by the graphics hardware.

**ezValidator™**
Simple and practical tools to validate seismic character correlations in faulted and folded areas. The technology enables the interpreter to un-fault and unfold seismic to look at stratigraphy and better correlate horizons across faults.

**Vertical Images**
The software displays XYZ-referenced vertical images in the context of seismic data and regional interpretation. These can be published as cross sections or scanned seismic images with stacked seismic data to better understand fluid or fracture orientation makeup at targeted events.
**Prestack Data and Modeling**

DecisionSpace Seismic Analysis software provides direct access to processed volumes, which can then be quickly viewed or plotted in a number of orientations (1D, 2D, 3D, map views) to understand the data quality and conditioning requirements of the prestack gathers. Prestack can be interpreted or processed to create new stack volumes. Powerful workflows allow the interpreter to model or correlate log and well data with prestack data to understand or validate geologic assumptions with seismic signatures.

**Attribute and AVO Cross Plotting**

The software provides workflow and analysis specifically designed for bypassed pay or fracture description. It consists of patented technologies that leverage unique autopicking and cross plotting of seismic attributes for classification and correlation with stacked seismic data to better understand fluid or fracture orientation makeup at targeted events.

**Microseismic**

Microseismic data visualization and fracture mapping techniques improve understanding of fracture treatment effectiveness. The data is displayed in the context of faults, horizons, log data, seismic attributes and reservoir properties in the asset team environment. Additionally, stimulated reservoir volume can be calculated quickly.

**Project Designer and Knowledge Capture**

Intuitive graphical flow chart tools create project workflow templates and capture workflow modeling steps in ODP or HTML. The application includes report files with capabilities of attaching documents, notes, images, and PDFs. Project Designer also includes batch file capabilities.

**3D Grid Design**

Flow-simulation-ready 3D grid construction provides vertical cell-walls and stair-stepped faults based on Cartesian geometry. DecisionSpace® Geosciences Earth Modeling suite uses the identical grid topology as Nexus simulator software, so the workflow from the static earth model to the dynamic simulator is seamless. Interactive tools allow users to design any shape area of interest within the boundary constraints of the structural framework.

**Natural Fracture Network**

Enables natural fracture network modeling to be performed for fractured reservoirs such as carbonates, basement, and unconventional reservoirs. Can use wellbore fracture interpretation, regional analysis, as well as secondary data like seismic or properties.

**Variogram Computation and Modeling**

The application includes patented tools used to compute, model and visualize omni-directional, multi-directional, and nested variograms for continuous and discrete attributes from point sets or 3D grids. When computing the variogram, the defaults given by the application are intelligent defaults, which means that defaults are not constant for every data set. Instead users look directly at the data and provide the best defaults to use with the data available. Variogram modeling also includes an instant visual validation map showing the effect of the variogram model on the model in a live-interactive mode.
System and Software

SOFTWARE REQUIREMENTS
OpenWorks® 5000.10.3
DecisionSpace® Base module and OpenWorks licenses are required

OPERATING SYSTEMS
Red Hat® Enterprise Linux®
Workstations 6.6, 64-bit
Windows® 7, 64-bit

Facies Trend Computation and Modeling
Powerful workflows create geographically varying 3D lithology proportion volumes from well and seismic attributes, which are then used as background trends during facies simulation. Users can interactively edit copy and move individual proportion curves to better define or customize the background trend.

Stochastic Facies and Petrophysical Property Simulation
An easy and unique workflow to create multiple facies realizations and populate them with petrophysical properties is critical for modeling fluid flow. Instantaneous visual validators allow users to preview results quickly prior to execution to ensure outcomes are reliable. Also, having the ability to use multiple facies simulations linked to multiple petrophysical realizations at the same time allows these results to be used in volumetrics computations to get a more complete probability when calculating P10, P50 and P90.

Probabilistic Volumetric Computation
Application tools compute and display probability curves depicting the risk of hydrocarbon volume based on stochastic facies and petrophysical property realizations. Volumetrics can be used with gas, oil and mixed reservoirs.

Uncertainty Analysis
Conduct uncertainty analysis using tools for creating summary volumes from multiple realizations (mean, standard deviation, 1st and 2nd confidence intervals, probability above, below or between cut-offs).

Upscaling
The upscaling component is used to create coarser grids while keeping fine grid detail around critical areas like faults for use in flow simulators. Several algorithms and methods are available, including classic upscaling methods using appropriate averaging techniques for porosity and permeability, as well as dynamic flow-based permeability upscaling based upon the pressure solution obtained by flowing a single-phase fluid through the fine-grid gridblocks which comprise each coarse gridblock.

Well Planning
Collaborative well planning offers multiple methods for ensuring well designs are well placed, planned accurately, and portrayed properly to the entire geoscience and engineering team.

DecisionSpace Geosciences 10ep software delivers a complete end-to-end solutions suite that improves asset team performances.

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.