DecisionSpace® Geology Software

OVERVIEW

DecisionSpace® Geology software provides geological interpretation, mapping, and modeling for asset teams. The software improves traditional correlation and cross-sectioning tasks by leveraging industry-leading topology technology, geologic conformance concepts, along with advanced fault prediction and horizon geometry projection technology. Traditional geologic interpretation tools, in combination with Landmark’s Dynamic Frameworks to Fill® software technology, enable a powerful workflow that delivers a step change in efficiency for structure and property mapping. Geoscientists can build a sealed structural framework while they interpret, filling the framework with facies and deterministic reservoir properties, and create accurate maps in minutes. Manual, time-consuming tasks, like fault-polygon digitizing, are a thing of the past. Updates dynamically populate through the model as you interpret or add new data.

DecisionSpace Geology software is a component of the DecisionSpace Geosciences suite, a unified visualization, interpretation, and modeling workspace where asset teams can collaborate more effectively to evaluate and develop assets. It delivers a true multi-user environment with unprecedented integration across multi-domain workflows and data types—all on the award-winning, information management foundation of the OpenWorks® database.

BENEFITS

More Efficient and Robust Geologic Workflows

Powered by Landmark’s innovative Dynamic Frameworks to Fill software technology, geologic interpretation can be created faster than traditional methods. These technically advanced and robust interpretations leverage advanced topology technology and classic geologic concepts.
A Step Change in Map Making

Mapping in the DecisionSpace environment is a byproduct of framework construction. Auto-generation of fault polygons and dynamic grid updates accelerate the process. Conformance mapping aids where well data is sparse. Property mapping uses the framework to define intervals that can be mapped.

Team Collaboration and Compressed Learning Cycles

The DecisionSpace unified workspace encourages asset team collaboration across traditional disciplines, and supports improved workflow efficiency. Dynamic connectivity between section, map, and cube views, in addition to workflow integration across geophysics, geology, and modeling domains, can lead to more accurate subsurface interpretation and compressed learning cycles.

FEATURES

Unified 1D/2D/3D Workspace

Interpretations in section, map 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.

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. New functionality in the DecisionSpace Geosciences 10 release includes expansion of the well templates function to include: dipmeter data, well notes, zone attributes, direction survey points, surface and fault picks.

**Well Display**
Well-specific layouts enable unique user-defined displays per well in the same view. Display property editors enable user-defined displays on a per object basis.

**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 well zones in the project, to understand and validate which critical parameters affect successful production.
Production Data Analysis

DecisionSpace Geology software allows users to perform decline curve analysis, which generates a prediction of estimated ultimate recovery on a well-by-well basis and predicts production lifespan based on economic cut offs. This information can be further analyzed using ZoneManager software.

The structural Dynamic Frameworks to Fill models feed automatically into 3D geocellular-based geostatistical property distribution found in DecisionSpace Earth Modeling. Similarly, DecisionSpace Geology software is tightly integrated with DecisionSpace Well Planning software to interactively develop, in-context, full-field well plans.

Dynamic Frameworks to Fill Workflow

A structural framework topology engine enables sealed framework construction as you interpret. 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 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 be created in minutes without manual fault-polygon digitizing and regridding.

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.
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

Fault Networking

Fault networking and modeling operations link faults and also establish a fault hierarchy using manual and automated workflows. Fault networking seals the framework and creates the essential fault block compartments necessary for accurate volumetric calculations.

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.

Structural Modeling Tools Include: Geometry Projection

The Geometry Projection tool allows the creation of two essential fold styles: parallel (true stratigraphic thickness) and similar (true vertical thickness). Projection geometries, which are essential for extrapolating key horizons into areas of poor data constraints, also provide information on the kind of rocks being folded and their deformatonal setting.

Fault Prediction

Fault prediction is a useful tool for interpreting faults in areas of poor data constraint, particularly the deeper portions that are poorly resolved. Based primarily on the geometry of a hanging wall fold, fault prediction generates the required fault that allows for restoration of the adjacent rocks to a balanced, pre-faulted configuration in the section of interest. It supports flexural slip and vertical/oblique slip prediction models to accommodate compressional or extensional settings and competent or incompetent rock types.

Trishear Tool

The Trishear tool uses a linked fold and fault modeling algorithm where a triangular zone of distributed deformation propagates along the fault tip. The Trishear tool can be used to both forward model undeformed layers and to restore folded and faulted structures. The Trishear task provides a large number of parameters that control the type of deformation that is being modeled.

Geoscientists quickly build a sealed structural framework while they interpret, and then fill the framework with facies and deterministic reservoir properties to create accurate maps in minutes.
**Complex Geometry Fields**
The Complex Geometry tool allows projection and interpolation of complicated non-constant thickness bedding geometries, as well as analysis of the associated bedding dip and curvature. Complex Geometry creates bedding attribute fields that can be defined by one or more horizons, and its bedding geometry may, but need not, conform to constant-thickness parallel or similar geometries. In addition to being able to interpolate complex bedding shapes between more tightly constrained horizons, the modeled dip and curvature attributes can be useful proxies for deformation intensity and tectonic porosity/permeability distributions.

**Restore Tool**
The Restore tool transforms the shape of folded layers, typically to a less-deformed or unfolded restored configuration. Comparison of the restored geometries of hanging wall layers (above a fault) with their corresponding footwall layers (below the fault) is a classic interpretation validation process. The available kinematic models include flexural slip (often appropriate for deformation of competent rocks in a compressional structure) and vertical/oblique slip (appropriate for analysis of incompetent rocks and extensional structures).

**Fault Propagation Fold and Fault Bend Fold**
The Fault Propagation and Fault Bend Fold tools are used to analytically forward model validated ramp anticline structures formed by layer-parallel flexural slip along non-planar faults. The tools include the ability to model additional imposed shear strains on a structure, and for interactively solving for parameters such as forelimb thinning or thickening.

**Dipmeter Analysis**
The dipmeter analysis feature provides a simple, but powerful, evaluation of wellbore dipmeter data, including stereonet display, calculation of the statistical best-fit fold axis and average plane orientations, and an estimate for the horizon geometry that honors the selected dip data. The tools are particularly useful in areas of poor data resolution. Dipmeter analysis answers questions regarding data consistency, the best orientation to analyze the dips, and the structure of the sampled layers.
**System and Software**

**SOFTWARE REQUIREMENTS**
- OpenWorks 5000.8.3.0
- DecisionSpace Base module
- DecisionSpace GIS module to run GIS workflows

**OPERATING SYSTEMS**
- Red Hat® Enterprise Linux® Workstation 5.3, 64 bit
- Windows® 7, 64 bit

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**Next Generation Mapping**

Dynamic Frameworks to Fill software technology enables and streamlines the interpreter’s ability to develop prospects within highly complex structural and stratigraphic plays. Topology tools and conformance technology produce robust, high-quality frameworks and maps. Structural mapping as an integral part of framework construction ensures internal consistency across multiple mapping layers, and forms the basis for property mapping. The ability to map zone-based, log-derived properties and to automate the updating of structure and property maps as data are added or edited, significantly improves mapping efficiency.

**Volumetrics**

DecisionSpace Geology software provides gross rock volume calculations leveraging the Dynamic Frameworks to Fill workflow to easily define and update the container for mapping fluid contacts, basic spill point, and hydrocarbon pore volumes within specific reservoir compartments—including depth/area and depth/volume plots. The software streamlines analysis of what-if scenarios.

**Horizontal Well Correlation**

The Horizontal Well Correlation add-on component assists geoscientists in correlating logging-while-drilling data from the horizontal portion of a well to data in the vertical portion of the well or nearby offset wells. The software uses horizontal well correlations to help determine the stratigraphic position of the wellbore, and in turn automate updates to the target-formation map. This technology integrated with real-time data, Dynamic Frameworks to Fill mapping technology, and advanced well-path planning capabilities enabled by the unified DecisionSpace environment, delivers unique “look-ahead” well planning and geosteering workflows. The ability to steer the drill bit through the most productive zones in the target formation is one of the critical operations affecting the financial success of shale and other plays.

Horizontal Well Correlation software helps geoscientists determine the stratigraphic position of the wellbore in horizontal wells and supports powerful geosteering workflows in the DecisionSpace environment.
“Having structural interpretation and framework modeling in the same system is much better than separate applications.”

GEOLOGIST

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