OVERVIEW

Complete end-to-end integrated Borehole Data Management (BHDM) Project Data Management (OpenWorks) solution bringing efficiencies where organizations spend 30 to 40% of time looking for high value logs.

BENEFITS

*Formation evaluation like never before.*
DecisionSpace® Petrophysics harnesses the power of the innovative DecisionSpace Enterprise E&P platform to bring new insights to your assets. From its industry-leading information management platform to its time-saving petrophysical analysis capabilities, everything about DecisionSpace Petrophysics is designed to make formation evaluation simpler and more efficient.

*Collaborate across domains.*
DecisionSpace Petrophysics closes the gap between geophysics, geomechanics, geology, petrophysics, reservoir engineering and production engineering. Real-time shared subsurface data and dynamic updates enable continuous collaboration across multiple asset teams. The result: better reservoir definition, accelerated workflows and safer operations—even in the most complex plays.
Answers, delivered.
Whether you’re looking at a single well or an entire basin, DecisionSpace Petrophysics helps you deeply understand rock and fluid behavior, so you can make faster decisions and accurate well placement, and how to improve net present value (NPV). Asset teams can now optimize performance throughout every stage in the asset lifecycle.

DecisionSpace Petrophysics integration with DecisionSpace Platform provides seamless access to data and full lifecycle management of borehole information in 3D.

FEATURES
Rock Physics (Acoustic Waveform)

Acoustic waveform processing and diagnostics enables the user to process acoustic waveform data to determine compressional, shear, Stoneley, flexural, and quadrupole wave slownesses as well as calculate cross-dipole anisotropy. The module uses semblance processing to generate correlograms which can then be displayed as variable-density log (VDL) and interactively picked to identify the various components of the waveform.

Acoustic travel times then can be used in standard petrophysical analysis, e.g., porosity, multi-mineral solvers, as well as in Geomechanics, and Rock Physics modules to calculate elastic rock properties or synthetic seismograms.
**Geomechanics** (Wellbore Stability, Pore Pressure, Sandpit3D – rock failure in sandstone reservoirs)

**Geology – Image Analysis, Rock Typing**

3D image log view and interpretation analysis views allows identification and evaluation of geological features required for stratigraphic interpretation.

**Image Analysis**

Image Analysis enables Image Log Data from a variety of tools to be processed within the software. When processing Image log Data using the Image Analysis module, the following tasks can be completed:

- **Image Corrections:**
  - Fill Gaps
  - Accelerometer
  - Depth Align
  - Gain
  - Streak
  - Negative Tapering

- **Picks**
  Planes that intersect the borehole appear as sinusoids on the unrolled flat view. Sine curves can then be traced over Features. From these identified features, the software calculates a depth, angle and azimuth shown as pick/tadpoles in log plots.

- **Plot and Manage Picks:**
  - Define Pick Types
  - Define Pick Relationships
  - Define Picks as Features
  - Automatic Picking
  - Auto Dip Calculation
  - Auto Dip Generation
  - Auto Dip Pick

Image Analysis Data can be plotted and viewed using either of the following options:

- Log Plot
- Tadpole and Stick Plots
- Mini Plots
- Dip Polar Plots
- Rose Plot
- Walkout Plots
- Cumulative Plots
- Wellbore Cross Section
- Stereonet Plots
- Image Histograms
- Fracture Analysis
A 3D Viewer for the Image Analysis module allows you to see a high resolution, dynamic visualization of their image log data.

- **Petrophysics** – Volumetrics, Saturated Water (Sw) Height Modeling, Flow Units, 3D Mineral Solver, Monte Carlo Analysis, Curve Prediction, Unconventional Evaluation Geosteering, Self-Organizing 2D/3D maps.

- **Reservoir Engineering** – Formation Test Analysis, Sw Height Modeling, Hydraulic Flow Units

**Production Engineering – Cement Analysis**

The Cement Evaluation Module is part of the Cased Hole tool suite which analyzes the quality of the cement bonding behind casing and its likely ability to provide the required hydraulic isolation of zones within the well based on imported Cement Bond Log data.

*Cement evaluation log analysis plot enables assessment of casing integrity and cement bond quality between casing and formation.*

**Data Management**

Comprehensive industry formatted data loading, quality control and editing tools speed up delivering quality logs to log analysts and petrophysicists.

- Data Viewers for log plots, cross plots and histograms with statistical summaries
- Data Listings
- 3D Parameter Viewer
- Well Maps
- Multi-Well Correlations
- Montage Viewers
• Data loading capabilities will include all industry formats:
  • ASCII
  • LAS2, LAS3
  • LIS
  • DLIS

• DecisionSpace Petrophysics leverages Landmark Data Management repositories, Information Management and Platform technologies.
  • OpenWorks – Log Store
  • Recall™ – Borehole data
  • InSite - for Real-Time data

**DecisionSpace Petrophysics Editing Features include:**
• Interactive Curve Edit
• Interactive Baseline Shift
• Interactive Trend/Square Curves
• Interactive Depth Shift with Auto Depth Match option
• Interactive Curve Splice
• Interactive Lithology Curve editor
• Curve Filters and Averages
• Curve Rescale
• Fill Data Gaps
• Temperature Gradient Calculator
• TVD Calculator

**DecisionSpace Petrophysics Multi-Well Features include:**
• Multi-well Parameter Distribution – copy ‘Parameter Sets’ from one well to other wells in the same project
• Multi-well Change Parameters – change one or more interpretation parameters and re-run the analysis with the new parameter(s)
• Multi-well Batch Operation – create and run scripts, on one or more wells, in a single ‘batch’ procedure
• Multi-well Correlation Viewer
• Multi-well Cutoff and Summation
• Multi-well Curve Statistics
• Manage Multi-well Header Info
• Manage Multi-well Curve Sets
• Manage Multi-well Curve Headers
• Manage Multi-well Zones/Tops
• Curve Aliasing
Enhancements and value add to DecisionSpace Geology:

- Log Plotting and Printing:
  - Log Plotting and Printing enhancements
  - Develop the Single Well Petrophysical View Multi-Valued Curves
  - Enable the use of Multi-valued curves

- Multi-valued Log Curves will support:
  - NMR analysis as well as other Multi-valued log curves
  - Display of Impetus FMI data
  - Expand HWC into azimuthal interpretation

DecisionSpace Petrophysics for Unconventionals

- Unconventional Reservoir Evaluation: The Unconventional option is used for quick computations and to assist selection of input parameters for the other modules in the Unconventional Resources suite.

- TOC (Total Organic Carbon) calculations can be performed from density relationships. Fourteen different density relationships are used to predict TOC and combined through averaging.

TOC analysis plot
• **Rock Mechanics**: Module computes dynamic rock mechanical properties and horizontal to vertical stress ratio based upon bulk density, sonic p-wave travel time, and sonic s-wave travel time.

## System and Software

### SOFTWARE REQUIREMENTS

<table>
<thead>
<tr>
<th>PLATFORM</th>
<th>THIRD PARTY TOOLS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DS Petrophysics Client:</strong></td>
<td>Java 1.8 u25</td>
</tr>
<tr>
<td>O/S Primary: Windows 7 (64bit); Server 2008</td>
<td>GeoCalc 6.4</td>
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<tr>
<td>O/S Secondary: Windows 8.1; Server 2012; Windows 10 (smoke test)</td>
<td>Eclipse 4.4.2 (Luna)</td>
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<tr>
<td>NVIDIA Drivers: Primary: Windows 347.52*</td>
<td>Linux GCC 4.4.7</td>
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<tr>
<td>Secondary (Tesla cards only): Windows 341.05*</td>
<td>Windows Visual Studio 2012 SP1</td>
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<tr>
<td><strong>OWG/DSIS Server:</strong></td>
<td>ESRI ArcGIS Runtime 10.2.4</td>
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<tr>
<td>O/S Primary: RHEL 6.6 (64 bit)</td>
<td>.NET (TBD)</td>
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<tr>
<td>O/S Secondary: RHEL 6.4 (64bit), RHEL 7.1 (64bit) (smoke test)</td>
<td>QT 4.8.5</td>
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<tr>
<td>O/S Primary: Server 2008</td>
<td>FEI/VSG 9.6</td>
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<tr>
<td>O/S Secondary: Windows 7(64bit); Windows 8.1/Server 2012, Windows 10 (smoke test)</td>
<td>BlueMarble 6.4.2</td>
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<tr>
<td><strong>Primary:</strong> Oracle 11.2.0.4</td>
<td>SQILite 3.7.17</td>
</tr>
<tr>
<td><strong>Secondary:</strong> 12.1.0.2</td>
<td>Chrome (DSIS/DSDS)</td>
</tr>
<tr>
<td><strong>OpenWorks 5000.10.3</strong></td>
<td>SharePoint (DSIS/DSDS)</td>
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</tbody>
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### SECURITY, DEPLOYMENT & COMPLIANCE IMPLICATIONS

**Application Hosting & “Cloud” Configurations**

- Remote Graphics
  - **Primary:** HP RGS 7.1 (March 2015)
  - **Secondary:** Citrix HDX, Mechdyne Telegraphix
- Virtualization:
  - **Primary:** none, “bare metal”
  - **Secondary:** VMWare w/GPU pass through

### DEPENDENCIES AND INTEGRATION IMPLICATIONS

**DS Petrophysics 10ep requires OW 5000.10.3**

**DSIS 5000.10.4** – DS Petrophysics will be compatible with DSG 10ep will run against OW 5000.10.3

**DSIS/DSDS – DSIS 5000.10.4**

### OTHER CONSIDERATIONS (INCLUDING LICENSING AND COMMON GROUND)

Customers upgrading from 5000.8.3 will need to upgrade their license server to utilize LGCX licenses.
Linking well to the field and making sure the correct information is available at any moment for reservoir characterization activity can only be possible by having a borehole and project data management available for all teams.

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.