

Software technologies are instrumental to E&P risk management

Reducing risk while maximizing assets is one of the main challenges facing the oil and gas E&P industry.

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Over the years, software development companies have invested vast resources in developing techniques and methodologies for minimizing drilling uncertainties to reduce risk.

Volume visualization, interpretation

Advanced volume visualization and interpretation environments can assimilate structural and stratigraphic detail at seismic and well log scales, improving the accuracy of structural, lithological, and pore content interpretations. When applied to reservoir characterization projects, the improvement in accuracy can be used to detect and model subtle heterogeneities in the reservoir that can be incorporated into geologic models. This process can be used to extend reservoir definitions, determine drilling locations, improve the risk assessment of predicted overpressures, and plan to minimize production decline.

Pore pressure prediction

Pore pressure prediction has an impact on drilling safety and the economics of drilling design and well construction. Pore pressure models, derived from the integration and calibration of wireline, petrophysical, seismic velocity, and field test data, provide information needed to make critical predrill stress and overpressure predictions and secure a safe and cost-effective well program.

Geological control, uncertainty estimation

Geostatistical tools can help outline an initial distribution of formation properties as well as preliminarily populate

values in areas that lack local calibration. Geoscientists can use this early information to guide initial interpretation efforts. Once interpretation takes shape, interpreters generally adapt the horizon and fault-picking process to their idea of what makes geological sense based on their experience in the region and knowledge of analogous geological settings.

New automated model-building technologies enable objective verification of the interpreter's assumptions made during the picking process. Recent technological breakthroughs have

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led to a dramatic acceleration of the model-building process, which makes it possible to evaluate uncertainty regarding the model's accuracy by generating many models with varying parameters. The interpreter need only verify which of the scenarios are the most geologically plausible and assess the risks.

New seismic data imaging, analysis techniques

A new technology for seismic data imaging and analysis extends the information contained in legacy and modern recorded seismic wavefields by providing comprehensive 3-D solutions for visualizing and analyzing the information contained in 3-D gathers, known as reflection subsurface angle gathers.

This technique provides extensive information about the reliability of the subsurface image in both land and marine environments, helps the user understand why depth imaging could have failed in specific subsurface areas, and indicates which steps should be taken in areas requiring improvement. For the first time in the industry's history, it is possible to unravel the exact way in which each point in the subsurface is illuminated by seismic, with comprehensive tools to assess anomalous ray paths, poor or irregular coverage, blind spots, and other critical information.

Much of the guesswork is taken out of the interpretation process, especially in high-risk plays under salt domes or in overthrust belts. The technique, which recently has come onto the market, delivers higher accuracy, efficiency, and certainty in seismic imaging, velocity model determination (tomography), high-resolution reservoir characterization, and fracture detection.

Well planning, drilling

Highly integrated well planning and drilling engineering technologies, including geosteering, help operating and service companies identify hazards in the well planning phase and the subsequent tracking of the actual well's progress, reducing drilling uncertainty and risk. They also support real-time correction to well trajectories during drilling based on comparison of actual LWD measurement relative to modeled values for the pay zone and surrounding formations.

Looking ahead

E&P software developers have much to offer in terms of increasing reliability and reducing drilling risk. This is of value in both furthering best practices for HSE and improving the economics of drilling activity by reducing the number of rig days spent addressing unforeseen subsurface conditions. **E&P**