Using reservoir intelligence to improve production, lower risk
Paradigm partners with GE, Dassault Systèmes on new insights

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The largest unknown in oil recovery remains the reservoir: it’s the source of economic success or failure, yet we cannot touch or see it. Organizations understand the need to better quantify the production potential from their reservoirs, but they fail to recognize the impact of the reservoir on their operating decisions. In many cases, well planning and reserves estimations are done with close evaluation of reservoir characteristics, but daily operations happen independently of this carefully developed information. We can do better if we break down the artificial barriers preventing collaboration.

Paradigm and its partners are focusing on two key solutions for bringing reservoir insight into production operation decision making. The first, partnered with GE, is called reservoir-driven production optimization (RDPO). The second, partnered with Dassault Systèmes, is reservoir-driven production risk management (RD PRM). These solutions, combining services and software in a concept, take the existing information from the asset evaluation and the operations, and combine them to optimize production and reduce risk.

Reservoir-driven production optimization focuses on three key uses — infill drilling, well interventions, and flood optimization. The importance of reservoir intelligence is perhaps most obvious in the case of infill drilling. To economically produce from an asset, it is important to space wells appropriately and continue to drill in the direction of the fluid migration. Clearly, a reservoir model is needed. However, organizations typically run reservoir fluid simulations infrequently, often once every few years. The process is computationally intensive and requires specialized reservoir engineers to ensure credible output. In addition, the output often isn’t easily available to or used by engineers in the field. RDPO provides techniques for quickly calculating past drainage without using a simulation. This data, overlaid with geologic structural information, can lead to smarter infill drilling decisions.

The next use for RDPO is in improving well interventions for artificial lift selection and sizing. Production engineers must select from different lift types ranging from electrical submersible pumps (ESP) to gas lift to rod pumps, and motor sizing of these pumps must be configured. ESPs need to be changed with thirsty years — and sometimes yearly depend- ing on reservoir conditions. RDPO allows these well-intervention decisions to be planned and evaluated within a 3D geologic model.

Finally, RDPO can be used for flood optimization. Production teams receive a production target and attempt to configure production parameters at each well and injector to reach that target. But increasing flow in one area of the field can reduce or even damage flow potential in another. RDPO helps manage flooding operations by fieldwide opti- mization.

Equally important is the need to manage risk — the focus of reservoir-driven production risk management. Reser- voir engineers undergo change due to depletion, including subsidence. Changes in subsurface stress over time can cause reservoir compartments to close or open, wells can fracture and break. Operators have experienced billions of dollars in production losses due to downtime related to such failures. In deep water, rigs have been abandoned due to subsidence.

RD PRM helps quantify risk to better avoid this outcome. The workflow involves creating a high-resolution geomechanical model of the subsurface and a good rep- resentation of properties impacting flow, such as pressure, porosity, and permeability. Fluid and stress simulations are conducted to understand how the change in flow will impact reservoir stresses. By evaluating these risks, drilling programs can be designed and production kept within appropriate lev- els to circumvent such failures.

The benefit of the integrated Paradigm-Dassault Systèmes solution is its ability to conduct this analysis in high resolution. The Paradigm static model seamlessly connects to the Dassault geomechanical simulator, ensuring a fast and efficient workflow.

Most critical is the need to accurately represent subsur- face structure. Paradigm differs from traditional approaches in that finer structures do not need to be eliminated from the static representation in order to accommodate the model. This rich detail then can be fully processed by the Dassault simulator to ensure that geomechanical failure risks are accu- rately represented.

This approach can also be applied to production optimi- zation in unconventional reservoirs. In shale assets, the key to production is fracturing the rock. Understanding the geomechanical response to stimulation helps understand the extent of stimulated rock volume that can be derived from a given completions program. Here again, it is important to capture the reservoir properties near the well bore in high resolution and then simulate the output — in this case, represent the growth of hydraulic fractures.

Both RDPO and RD PRM represent the need to bring to- gether the disparate information available in reservoir and production teams to improve economic outcomes. In today’s environment, this is critical to every operator. To learn more, visit Paradigm at booth 3107 anytime or attend a special pre- sentation today, Oct. 17, at 12:15 p.m.