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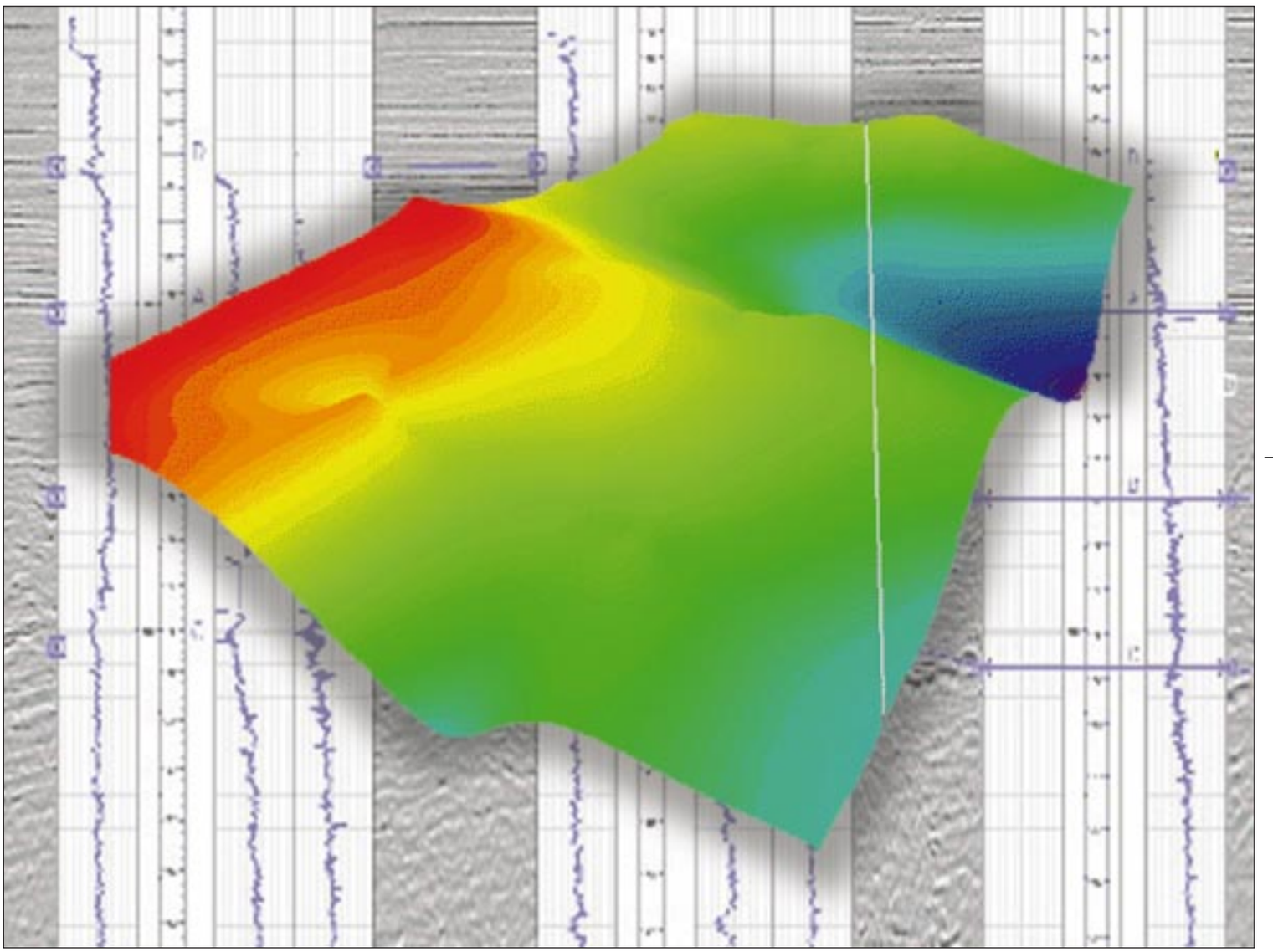


EXPLOITATION DATA MANAGEMENT PAGE 36

COLLABORATIVE EFFORT SEEKS COMPUTING PLATFORM FOR SHARED EARTH MODELING

Bob Tippee *Managing Editor-Economics and Exploration*

A coordinated industry project in its formative stages highlights major change looming for the work methods of exploration and production asset teams.

The project's core is a concept called shared earth modeling (SEM). Under development at a number of oil and gas companies and at least partly served by software available from several suppliers, SEM has strong industry support.

But it's still just a concept.

In the ideal view, SEM organizes the work of multidisciplinary asset teams around common earth models, which develop as team members contribute data and interpretation about subsurface volumes under study and which can be rendered in various ways to address different problems and accommodate different work flow requirements.

It sounds simple. It's not.

SEM requires changes in traditional work flows among the earth scientists, engineers, and financial managers who work in E&P asset teams. Achieving the needed coordination requires new understanding about how those workers think.

And SEM will require a "new generation of software," points out David Archer, president and chief executive officer of Petrotechnical Open Software Corp. (POSC), the industry cooperative formed in 1990 to develop information and computing standards for the E&P industry.

POSC hopes to create a common development environment for SEM software products. At the end of October, 11 participating companies agreed on the project's overall objective and goals for its first phase.

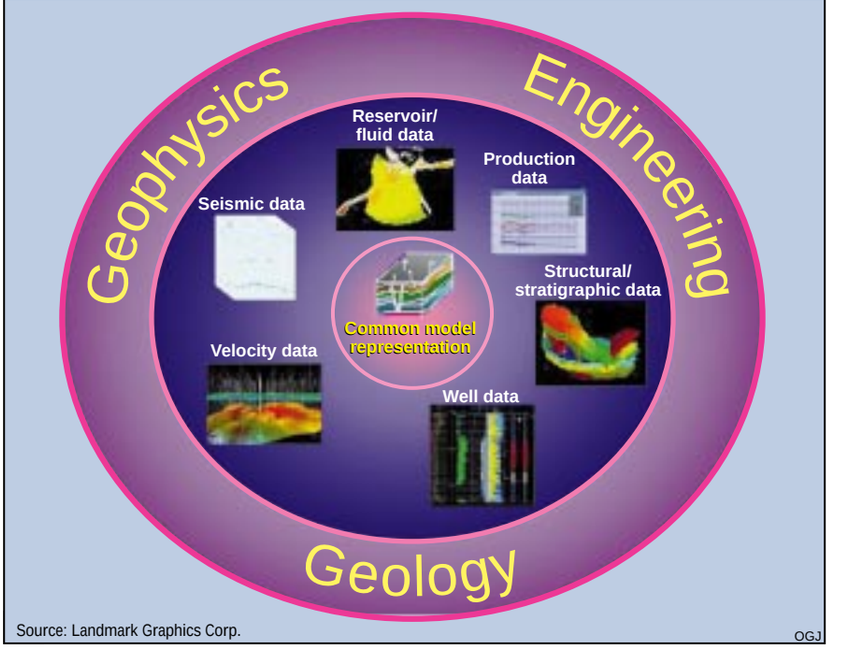
Much hinges on the outcome, notes Dan Schenck, POSC business unit manager: "This is a problem that's going to change the way people work."

Definitions and issues

A challenge to participants in the POSC project will be to agree on what exactly SEM is.

Fig. 1

INTEGRATING EARTH MODELS, WORK FLOWS



Source: Landmark Graphics Corp. OGJ

As Tim White, director of strategic earth modeling initiatives at Landmark Graphics Corp., points out, earth modeling is nothing new. Oil and gas companies routinely produce seismic and velocity models, well logs, structural and stratigraphic representations, and production and reservoir simulation models.

Usually, though, those models are "functionally siloed," handled with what White calls "serial processing" between E&P operations. Typical asset teams now have great integration of data but not of work flow processes, interpretation, and knowledge.

White says SEM "has a lot to do with getting out of serial processing and enabling an exchange of information and knowledge." It thus becomes a "model-centric approach to applications and work flows to solve business needs" (see figure).

A challenge of defining the SEM concept is that many models "must be aggregated into a common environment in order to form a shared understanding of the subsurface," White says.

Bill Quinlivan, Schlumberger's technical representative to POSC on SEM issues, explains, "Over its lifetime, an earth model is transformed between a number of representations, each specialized for one phase of the E&P work flow."

An early representation is the structural model—a geometric framework description based on seismic time data able to make distinctions between reflecting horizons and faults.

The framework model is transformed into a geocellular model to support stratigraphic interpretation and backstripping,

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What project's first phase aims to deliver

1 Functional scope
- —Applications that should be supported (agreed inventory of applications to be supported by the platform)
- —Functionality (analysis of the functionality that each application provides and abstraction of functionality into functional groups)
- —Broad definition of the scope of functionality and agreed "Hot Spots" for Phase 1
- —Items outside of scope (as agreed and why excluded)

2 Concepts and principles
- —Specification of required characteristics of the platform and rationale, for example
  - • Subsurface objects should be independent of representation
  - • Geometric calculations should be provided by a dedicated engine
  - • All subsurface objects should be viewed/edited through an open visualization service
  - • Services to manage/support flexible work flows
- —First cut definition of the conceptual building blocks of the platform
- —Principles to which the platform should conform

3 Industry activity report
- —Profiles of related initiatives within the E&P sector and within other sectors such as defense and manufacturing
  - • Relative scope of work
  - • Description of deliverables
  - • (Potential) relationship with POSC SEM project
  - • Candidate prototype technologies
- —Seminar papers

4 Preliminary specification
- —Description of architectural components
- —Illustrative universal modeling language (UML) and interface definition language (IDL) specifications for high priority components
- —Use cases illustrating how shared modeling functionality is provided

5 Request for comment (RFC) response
- —RFC
  - • Extracts of previous four deliverables soliciting comments
  - • Response form and guidelines
- —RFC response
  - • Analysis of industry feedback on RFC

Source: Petrotechnical Open Software Corp.

Quinlivan says. The geocellular model in turn is converted into a finite element representation composed of cells supporting representation and computations on various properties.

Upscaling of the property model's gridding yields a simulation model, which models dynamic fluid flow processes of the reservoir.

Traditional work flows treat each model discretely.

"Many times, we do things in the simulation that don't make geologic sense because they better account for observed production," Quinlivan says.

Expert knowledge

SEM thus goes beyond data to the practices and thoughts of workers using the data.

Chris Huston of Shared Earth Technologies, Denver, says SEM shifts the focus from data to its context. An important aim, in his view: "capturing the context of the data in relation to its global environment."

Since the main movement across asset teams now is of data alone, Huston explains, the next step is to effectively transmit knowledge of the experts by way of a model that the experts can express to the computer.

"SEM," Huston says, "increases the value of the model to enable it to be more expressive and make it able to move from discipline to discipline."

The challenges are to capture expertise and move the earth model seamlessly from the geophysicist to the engineer. The evolution requires what Huston describes as "storytelling" between the models.

SEM, in Huston's view, raises this competitive test: "Who can capture the most information out of the domain expert's head and propagate those models across disciplines most efficiently?"

Versioning and uncertainty

To do that, SEM will have to satisfy the needs of many users, which will require different renderings of the shared model—or technically different models that remain consistent with one another as updates are made.

A shared earth model is dynamic; it changes as the cumulative knowledge of the asset team grows. But individual team members contribute to the model at specific points in time relative to a specific version of the model as it existed at the time of the change.

In White's words, the SEM is "always being updated but always being accessed by different members of the team for different reasons."

And the updates can come in rapid succession. At least in theory, for example, nearly continuous model updates might occur during the course of drilling operations or seismic surveys.

So what happens when a new structural interpretation changes reservoir geometry while a fluid-flow simulation is in progress? The question shows the importance of keeping track of the timing of an interpretation and the version of the shared model to which it applies.

Change-management and "versioning" methods are under study to allow SEM systems to track model changes and to enable interpreters to backtrack through sequences of versions in search of errors.

Something else to be managed in an SEM environment is uncertainty. Because no earth model exactly matches its corresponding earth volume, every dimension of an SEM is wrong to some degree. The probable error inherent in each part of the SEM influences potential accuracy of dependent parts and the interdependent whole; information about the risk of error becomes crucial, as does the ability to identify and track variables most likely to affect the outcome.

Najib Abusalbi of Schlumberger calls managing uncertainty "one of the cornerstones" of SEM because it helps the asset team member understand the level of risk involved in the next decision.

How ambitious?

But Abusalbi cautions that uncertainty management and versioning represent "higher levels of ambition" that must be managed as SEM develops into a mature

set of standard specifications.

"One step at a time needs to be taken," he says.

A big step will be establishment of a standard infrastructure for the sophisticated computing needed to support SEM. That's where POSC enters the picture.

Its role is to develop industry standards for so-called commodity elements of the computational platform—the things that everyone will have to have and be able to do and that therefore represent limited areas of competition among software developers.

But the line between commodity and commercial applications is seldom clear.

The starting point is knowledge and standard definitions of data that are already public, which Quinlivan of Schlumberger notes "isn't very much." The problem: "How do you get more on the table?"

Inevitably, vendors and oil companies will be asked to share information they now keep to themselves—to weigh the benefits available from collaboration with the value of proprietary or competitive knowledge.

That's partly why Abusalbi seeks a step-at-a-time approach.

"Let's focus first on the part that is public," he says.

Beyond the sharing issue are questions about where POSC's work ends and competition begins.

Abusalbi says POSC will have achieved its objectives when the E&P industry reaches agreement on the specifications for products, rules for data storage, and methods of accessing the data store.

Huston of Shared Earth Technologies defines the issue as "what vs. how"—with the former defined in geoscience terms and the latter in computer terms. POSC, he says, should focus on "what."

The first step

POSC's Archer frames the key issue like this: "What's really a commodity, and how do we use that as a platform from which to compete?"

His organization's meeting in October took a first step toward sorting out that and other issues.

POSC, Archer says, hopes to work as a "neutral forum for collaboration" on industry standards for software able to support SEM. But even that raises a question.

"Where do the participants draw the line for collaboration?" Archer asks. A key aim of the early stages of POSC's work thus will be to determine "where some of these boundaries are."

Archer says POSC won't work toward one massive resolution of all SEM issues but will rather work in steps to make specifications available as they are developed.

Participants in the October meeting described the project's objective this way: "To define specifications for open interfaces and shared services that enable the implementation of a new generation of interoperable earth modeling products."

And they agreed on a set of "deliverables" for the project's first phase (see table).

POSC's Schenck says the group wants to "deliver some real value in the near term."

Archer stresses that POSC didn't invent SEM. Its project aims to generate benefits from collaboration in appropriate pieces of an evolution already under way in E&P industry practice.

"True SEM," says White of Landmark Graphics, "is magnitudes larger than anything the industry has done before. A stepwise progression is the only way to approach a solution to this challenge." ▪