AS SEEN IN
JANUARY 2012 E&P

# Seismic data processing empowers interpretation

A new methodology serves to mesh processing and interpretation.

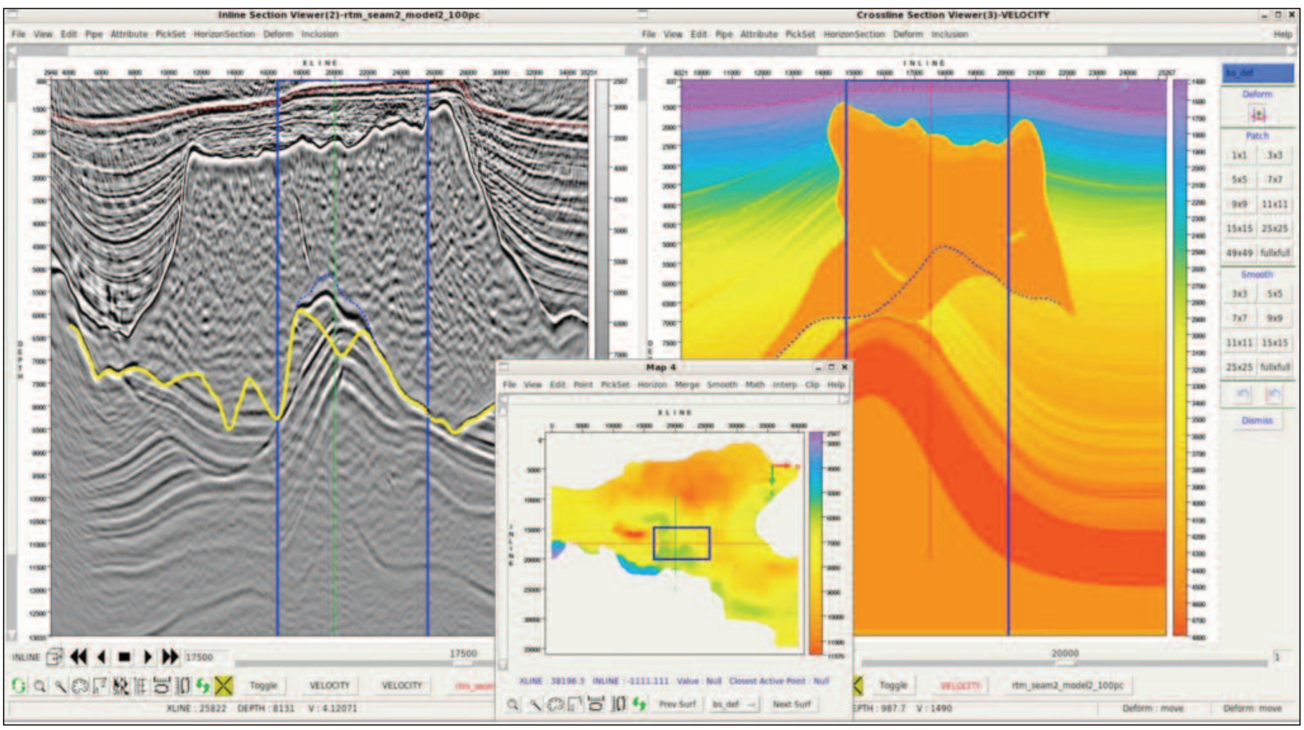
**Dave McCann**, Woodside Energy (USA); and **Agata Comas**, **Gary Martin**, Adrian McGrail, and **Jacques Leveille**, ION Geophysical

It is often said that seismic data processing is an interpretation. But in reality, seismic interpretation and seismic processing have been, for the most part, different disciplines with different expertise and software platforms. Today the most common practice in E&P is to have a chain of independent tasks: seismic acquisition, processing, and then interpretation. The interpreter is usually made aware of the quality and difficulties of the data at the very end of the process, when the data are finally loaded on his or her interpretation platform.

While functional, this process is inefficient in terms of cycle time and, more importantly, the quality of the final product. A new paradigm, called real-time model morphing and migration or RTM³, has been developed to add efficiency to the process.

## RTM³

RTM³ is a tool that allows seismic processors to work closely with their clients to rapidly modify and test subsurface models. Using this approach, the team can work




**Various views guide the RTM³ user to interactively modify the base salt model in this example. The views are fully customizable to suit the user's preference. (Images courtesy of ION Geophysical)**

through the needed imaging iterations more quickly than would be possible working in isolation. To facilitate this level of collaboration, ION worked closely with its clients' IT departments to design an access portal through which geophysicists can securely access their data almost instantly from their own offices, without the need for complex data loading steps or custom hardware requiring capital expenditure. The rapid quality control (QC)/validation directly from the client's desktop using proprietary viewing tools and model building systems dramatically reduces decision time and thus the entire timeline, even for iterations that do not involve scenario testing. In this example, the use of $RTM^3$ is demonstrated within the context of salt modeling, but the tool has much wider applicability, such as any geobody modeling in a variety of geological contexts.

### Woodside's $RTM^3$ workflow

As the oil industry moves into a new basin or play, the first prospects that are drilled are ones that are easy to identify and understand. As the play matures, the opportunities become more complicated. This certainly has been the case in the deepwater Gulf of Mexico (GoM). At present, Woodside's exploration in the GoM is under some of the most complex salt that has been encountered so far. This has necessitated changes in the technologies that Woodside geophysicists use and the ways in which they use them.

To unlock the subsalt image, Woodside geoscientists must clearly and accurately define the geology above the target. The key element in this effort is to define the geometry of the salt. As the company has moved into areas with more complex salt, defining its geometry has been increasingly challenging. Geoscientists are encountering salt with multiple overhangs, wings, and significant inclusions, all of which must be accounted for in the model to get an image of the target.

Historically, building models of the salt would be accomplished by iteratively defining each element in a layer-stripping approach. This would take several months to perform, and it was only at the end of this process that geoscientists would be able to determine if the geologic model was correct or not. Needless to say, this prompted numerous reimaging projects.

$RTM^3$ allowed Woodside geoscientists to change their workflow. Currently, they model the part of the salt that is easy to identify in an initial pass coupled with a simple but viable geologic model of salt in those areas that are more complex. With this first pass, they solve 70% to 90% of the problem. They then review these results and define several additional models to test. This allows them to test several geologic models in a couple of weeks rather than one model in a couple of months. This has enabled Woodside geoscientists to build better images of their targets in far less time than they have been able to do in the past. By quickly testing multiple geologic models, the geoscientists have been able to converge on the right solution in less time than it had taken them to perform a project in the conventional manner.

Solving the shallow geology to improve the subsalt image is only one of the challenges. Ultimately, Woodside geoscientists need to understand the structural elements and rock properties of the target that they are pursuing. Key to this is a model that accurately images the events at the depths that they will be encountered by the well. Inaccuracies in depth will distort the structural picture, the size of the closure, and even the prediction of porosity. Over the years, the industry has incorrectly estimated the depth to the Wilcox on the order of 450 m to 610 m (1,500 ft to 2,000 ft). Woodside geoscientists have been using a proprietary approach to prepare an initial estimate of the subsalt velocity field, which they will subsequently update using $RTM^3$ and associated tools. Using this approach, Woodside geoscientists have accurately predicted the depth of the target as encountered in the well.

### A better model faster

$RTM^3$ has proven to be a very effective tool to allow E&P geoscientists to significantly reduce the cycle time to produce an accurate velocity model and thus create the highest QC of the subsurface without any algorithm compromise. Negating the need to transfer data back and forth between offices, the tool enables geoscientists to work closely with imaging teams during every stage of the process with hands-on QC capability of the data from their own offices via a secure network. This application is truly empowering the interpreter. E&P