

'Old Faithful' Gulf Area Almost Overlooked

Development 3-D Yields New Find

By KATHY SHIRLEY

EXPLORER Correspondent

Not all new discoveries in the Gulf of Mexico are in a frontier subsalt play or ultra-deep water. Thanks to cutting edge technology, operators are finding new fields in shallow, mature segments of the Gulf.

Texaco E&P recently announced just such a discovery in Eugene Island Block 354 – a block that had produced over 1.5 million barrels of oil.

Credit for the deeper pool rank wildcat discovery goes to 3-D seismic and new techniques for processing and interpreting the data.

The new Teal South Field is 160 miles southwest of New Orleans in 275 feet of water. The discovery well was drilled to a total depth of 8,430 feet and encountered 226 net feet of oil in four zones. A delineation well went to 10,945 feet and logged 320 net feet of oil and gas in seven zones. Texaco has a 100 percent working interest in block 354.

Texaco estimates peak production at Teal South will be 5,000 barrels of oil and five million cubic feet of gas per day.

The 5,000-acre Teal South lease is adjacent to Texaco's Teal prospect, a field they operate in Eugene Island blocks 338 and 339. Production from Teal South located to the southwest will be flowed back through this existing field, which helps make the project even more economically viable, according to Valli Chambers, a petroleum engineer on the Teal South team.

In fact, proximity to the older field on blocks 338 and 339 led to the discovery of Teal South – almost by accident.

Serendipity

In 1991 Texaco began interpreting a 3-D seismic survey over its existing field in blocks 338 and 339 as part of the company's ongoing development of the field, said Dick Andre, a geoscientist with the Teal South team. The survey lapped over into part of block 354, which was held by Shell at that time.

In the course of mapping the new 3-D data Texaco scientists saw hydrocarbon potential in block 354.

"By serendipity we had 3-D coverage on block 354 that was not available industry-wide," Andre said, "and we were able to identify some prospects."

In 1992-93, Texaco and its 50-percent partner Chevron drilled nine wells in the existing field based on the 3-D seismic data.

"We got good results on those wells and we developed quite a bit of experience and expertise in dealing with the data," Andre said.

"We felt comfortable with the risk factor on block 354 as a result of the experience we gained with the 3-D data set on blocks 338 and 339."

So, in late 1993 Texaco obtained a farm in from Shell for block 354.

"The block was an expiring lease and we had to find commercial hydrocarbons by April 1994."

Texaco accelerated the pace of exploration on the block – largely as a result of the cross-discipline team approach the company is using in the Gulf.

"Professionals in every phase of exploration and production are brought together as a team in one office," said Jesse Mericle, assistant division manager for Texaco's eastern region.

"This allowed us to turn this project around in a hurry."

Andre added, "The 3-D seismic data identified two pools 2,000 feet deeper but in the same sand sequence as production from blocks 338 and 339, that were not encountered by previous wells on the block," Andre said.

The abandonment of the older field on block 354 in the mid-1980s coincided with a sharp decline in oil prices.

Seismic Inversions

Based on their experience in blocks



338 and 339, Texaco scientists knew amplitudes on the seismic data were generally associated with hydrocarbons. Also, the data showed that in the older field the amplitudes were diminished in sands where the hydrocarbons had been depleted.

Several horizons in block 354 showed significant amplitudes, according to Kent Rinehart, another team geoscientist, indicating the presence of hydrocarbons and that

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A Smart 3-D Success Story

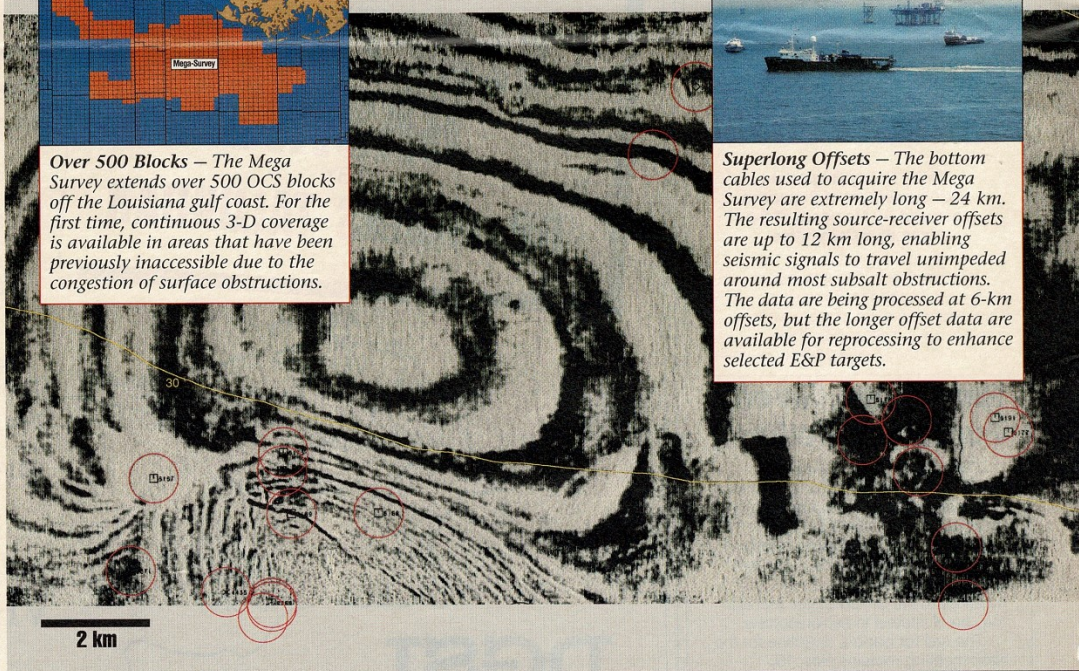
Mega Survey, Mega St



Over 500 Blocks – The Mega Survey extends over 500 OCS blocks off the Louisiana gulf coast. For the first time, continuous 3-D coverage is available in areas that have been previously inaccessible due to the congestion of surface obstructions.



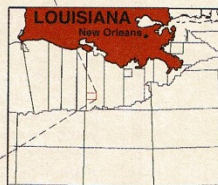
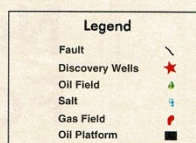
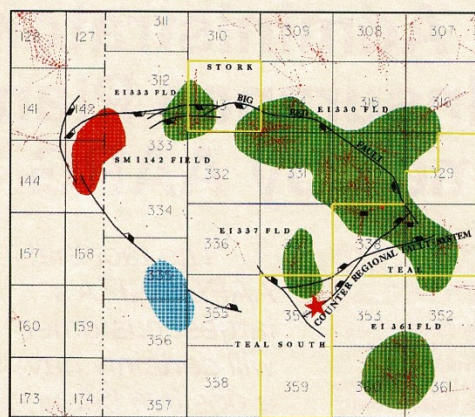
Superlong Offsets – The bottom cables used to acquire the Mega Survey are extremely long – 24 km. The resulting source-receiver offsets are up to 12 km long, enabling seismic signals to travel unimpeded around most subsalt obstructions. The data are being processed at 6-km offsets, but the longer offset data are available for reprocessing to enhance selected E&P targets.



Western is committing its technology and resources to cut across obstructions, see through salt, and reveal subsurface structures as never before possible.

Western Geophysical is currently acquiring and processing the Mega Survey, the largest 3-D survey ever conducted in the Gulf of Mexico. The data are being acquired using advanced bottom cable technology with the most innovative survey design and processing techniques. The resulting 3-D data have continuous coverage across surface obstructions and unsurpassed clarity of subsurface structures.

Western's intelligent combination of advanced technology and collaborative management is achieving remarkable results for prospects in the Gulf of Mexico and around the world. For more information, call Western's Spec Sales and Program Development Department in Houston at (713) 963-2500, in New Orleans at (504) 523-6781, or in Dallas at (214) 490-9832.



If It's Dry, It's Not 'Big Red's' Fault

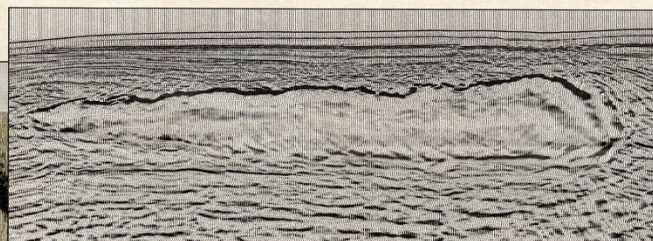
Eugene Island blocks 338, 339 and 354 are part of a large mini-basin that is downthrown to the Big Red fault – a large growth fault well-known in the Gulf.

Texaco's block 338 and 339 field is on the southeast flank of the Eugene Island 330 oil field, a giant field discovered from 1971 to 1973 with cumulative production exceeding 480 million barrels of oil equivalent, according to Texaco geoscientist Dick Andre. This giant field covers parts of seven blocks and was one of the first discoveries when drilling in the Gulf of Mexico moved into the 200 foot water depth.

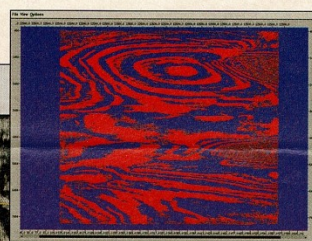
The mini-basin is bounded on the south and west by large counter regional faults and deep seated salt-cored structures.

Block 354 is over a deep-seated ridge cut by some of these large counter regional faults, which sets up prospective traps both upthrown and downthrown, Andre said.

Structures



Subsalt Imaging – Western runs 3-D poststack depth migration on a parallel supercomputer for fast turnaround. Once a target zone is narrowed, prestack depth migration can be used to image complex structures, such as reflectors beneath salt.



High Resolution, Low Noise – The data are being acquired at a tight 25 x 25m cell spacing. The acquisition system is recording 1,920 channels at a 2 ms sampling interval. The bandwidth is increased through Dual-Sensor™ recording and the ambient noise reduced significantly, allowing Western to reveal subsurface features previously hidden by high noise.

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earlier production had not depleted the reservoirs.

The scientists used a technique called seismic inversion in an innovative manner. Rather than inverting a single seismic line, the entire 3-D volume was inverted.

Seismic inversion is a process in which seismic amplitude data can be used to approximate an acoustic impedance log. Since the velocity of sound in hydrocarbon zone is significantly slower than in water sands, this technique can be extremely useful.

Texaco has a group in its New Orleans office that specializes in seismic techniques, including inversion.

"With seismic inversion we saw a strong correlation between slow velocity zones and hydrocarbons on the 3-D data set from blocks 338 and 339," Rinehart said.

"This allows us to see the difference between hydrocarbons and wet sands. And I've seen cases where you can predict sand thickness with seismic inversion – something that is difficult to predict from conventional data."

The quality of the productive Middle to Lower Pleistocene sand interval at Teal South is highly variable, but

"seismic inversion allowed us to get a good handle on sand quality and development on this 3-D data set," Andre said, "which is valuable in determining optimum wellbore placement."

Interpretations and Workstations

In addition to seismic inversion, Texaco used an interpretation workstation package called Stratamp (a Landmark Graphics product) on the 3-D data. Using it, the interpreters were able to analyze the data and search for areas of amplitude interpreted as hydrocarbons, Rinehart said.

"By tying this new prospective area with existing fields we were able to quickly get an idea of the aerial extent of the prospect."

The wildcat well was spudded last February and based on the log responses, RFT data and familiarity with the fields in the area, Texaco didn't test the well. The inverted 3-D seismic data was used to locate the well in the highest quality sands and to drill through the most pay zones.

"By using the 3-D to plan optimum well tracks we hoped to maximize proven reserves with as few wells as possible," Andre said.

"We saw all but one of the major

See 3-D Success, page 13

Surface Facilities

Water Depth (m)

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Good Science. Good Service.

3-D Seismic Atlas Planned

Authors, Papers Sought; Sept. 30 Deadline

Authors and papers are being sought for a special publication that will illustrate the use of 3-D seismic data in exploration and production geology.

3-D Seismic Atlas is a joint production sponsored by AAPG, SEG, SPE and SPWLA.

The book's technical content will feature case studies – both domestic and international – demonstrating 3-D seismic interpretation and its confirmation from drilling and production information.

Examples of topics to be included are:

- Case studies that illustrate how 3-D seismic data changed production strategies in field development.
- How 3-D seismic data have impacted the exploration of individual prospects.

□ The 3-D seismic expression of different structural styles (such as growth faults, salt features, basement-involved faulting, reverse and thrust faulting and wrench faults).

□ The 3-D seismic stratigraphic expression of features such as carbonate buildups, fluvial sandstones, deltas and turbidite systems.

□ Case studies emphasizing the integration of petrophysical data with 3-D seismic data.

□ Case studies involving the prediction of petrophysical properties from 3-D seismic data.

The deadline for submission of authors and titles is Sept. 30. Contact either of the co-editors: Paul Weimer, University of Colorado, Boulder, (303) 492-3809; or Tom Davis, Colorado School of Mines, Golden, (303) 273-3938.

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Today there's an effort to minimize the high-risk wells, Otis said, or at least reduce them to one chance out of 10. For the low-risk wells, the new process has now achieved a success rate of three out of every four wells.

Just how much has been saved, Otis said, is unknown, but he adds, "It's been accepted by management that the process has eliminated a lot of dry holes."

One of the main challenges in getting the new process accepted was winning the acceptance of the geologists.

"We knew it would be an uphill struggle to get the geologists to accept the process because of its centralized aspect," Otis said. "So it took us time to build credibility. And, though the world is not perfect, we feel we've come a long way toward achieving this goal."

Geologists throughout the company are now trained in the process.

"The role of the geologist is fundamental," Otis said. "They provide the information and parameters that go into the estimates."

Casing Out the Scene

This valuation process has been implemented worldwide, on almost all of the continents, in the United States, Canada, South America, Africa, Australia, Europe and the former Soviet Union. The process is also shared with Chevron's trading partners so that the costs are brought down on both ends.

Furthermore, personnel are recruited from operations to work in the centralized valuation process for relatively limited periods from one to three times. This provides a transfer of technological information from hands-on operations people, who, in turn, through their stint in the central organization, gain a global perspective.

All of the geological insights are ultimately related to engineering and economics both to maximize drilling successes and to minimize costs. Once the geologic analysis is completed and the volume of hydrocarbons is estimated, engineering support provides development scenarios for three cases described by the volumetric distribution:

- A pessimistic case (10 percent).
 - The mean case.
 - An optimistic case (90 percent).
- Economic evaluation is then run for each of the three cases, providing a range of economic consequences of the geological, engineering and fiscal framework.

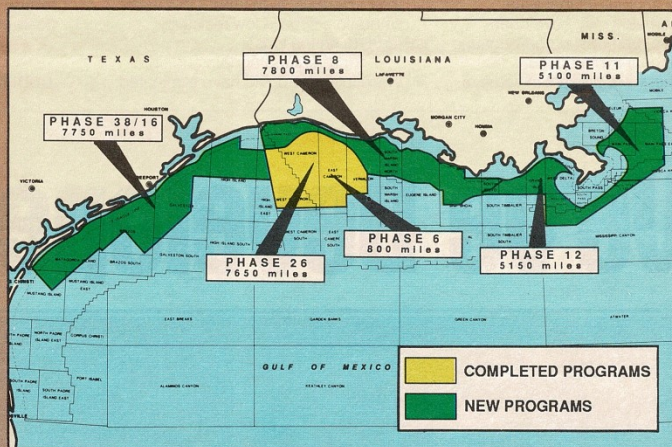
Although Chevron was among the first to formalize this valuation process, other major companies have been taking similar paths.

Where Chevron continues to differ is that, though its valuation process is centralized, it's still tied directly to the operating companies. And the economics are run as a part of the process procedures rather than in a different department.

"Even though our valuation process is centralized," Otis said, "we still maintain organic connections to the rest of the company." □

REGIONAL AVO PROJECT Miocene-Pliocene Trend, Louisiana & Texas

AVO PROJECT AREAS



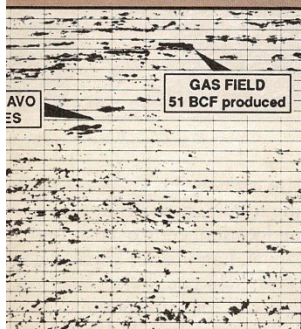
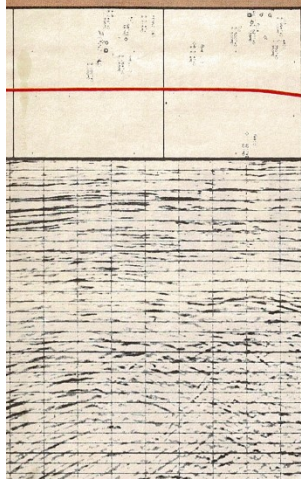
TGS-CALIBRE and SPECTRUM Geophysical are reprocessing a 1x1 mile grid of seismic lines through much of the Miocene and Pliocene Trends of Louisiana and Texas. The purpose of the project is to create Amplitude Versus Offset (AVO) displays to calibrate to existing production and to define new prospects in this mature region. This 34,000+ mile grid will ultimately represent the largest and most consistent analysis of amplitude versus offset ever achieved.

DELIVERABLES FOR THE PROJECT INCLUDE:

- Nine (9) AVO attributes plus Relative Amplitude Stack on tape.
- Three (3) AVO attributes plus Relative Amplitude Stack of film.
- DMO and non-DMO gather tapes.

To schedule a review of this or any other TGS-CALIBRE product, please contact John Adamick, Chris Corona, Kenneth Mohn, or Barry Eastland at (713) 951-0853.

Stop by booth 517 at the AAPG convention in Denver.



TGS/GECO Phase 26