

Exploration & Exploitation Offshore West Africa

Exploration and development can be challenging offshore West Africa, as legacy seismic datasets don't deliver a holistic, basin-scale understanding of the petroleum systems. ION was engaged by several of Africa's largest E&P operators to deliver a series of integrated seismic programs, collectively known as AfricaSPAN™, to improve their understanding of the crustal architecture of the West African margin, identify new reservoirs, and optimize their reservoir management plans for already-discovered fields. Using ION's data programs, along with ION's marine seismic acquisition technologies and advanced data processing techniques, operators are gaining new insights to high grade their portfolios in this highly prospective region.

BASIN EXPLORATION

Exploration & Exploitation Offshore West Africa

Challenge: Enhance economics of exploration & reservoir development.

Approach: Advanced seismic imaging, including seabed acquisition.

Result: Improved subsurface understanding.

HARD-TO-IMAGE TARGETS OFFSHORE AFRICA

Exploration and asset development can be challenging offshore West Africa. Legacy seismic datasets were not designed to deliver a holistic, basin-scale understanding of the petroleum systems along the West African margin. Reservoirs can be structurally complex with numerous intersecting faults and compartments. Conventional seismic images are often insufficient to delineate these structures, as the recorded acoustic data is frequently obscured by seafloor multiples and gas clouds. In some countries, the pressure to use indigenous oil field services firms is intense and frequently mandated within the operators' development agreements.

Several of Africa's largest E&P operators, who were planning multi-year, multi-billion dollar exploration and reservoir development programs, wanted to improve their understanding of the crustal architecture of the West African margin, to identify new reservoirs and optimize their reservoir management plans for fields that had already been discovered.

SANCTIONING THE REQUISITE SEISMIC IMAGING PROGRAMS

ION was engaged to deliver a series of integrated seismic programs beginning with CongoSPAN™, a basin-scale imaging program



designed to image deep within the crustal architecture offshore Angola. The insights delivered by the initial program resulted in a series of AfricaSPAN™ programs extending from the Cameroon volcanic line to the Gulf of Guinea. This was followed by the launch of ION's GX Technology (GXT) imaging centers in Luanda, Angola, and Port Harcourt, Nigeria, the latter in partnership with an indigenous partner – Bulwark Services, Ltd. These centers have since been awarded numerous PreSTM and PreSDM projects by E&P operators, including imaging projects requiring reverse time migration (RTM).

More recently, a major international oil company commissioned a multi-year VectorSeis® Ocean (VSO) program and awarded GXT a data processing contract for both p-wave and converted-wave (C-wave) imaging. This operator's objective was to eliminate seabed multiple problems and improve the bandwidth of the recorded seismic data to better resolve thin bedding layers and delineate faults and compartments within the reservoir zones. In addition, the C-wave data recorded by VSO enabled them to 'see through' gas clouds.

“These are the types of subsurface images we've been waiting twenty years to see.”

– Geophysical Program Leader,
International E&P Company

MAPPING CONJUGATE TIES

ION's AfricaSPAN library is among the company's largest, containing over 58,000 km of interpreted seismic data and has provided numerous insights into the region's depositional and tectonic history, including the identification of underexplored petroleum systems further offshore and in deeper parts of the geologic section. As the African basins are just beginning to be explored to their full potential, operators are beginning evaluate the potential of the conjugate margin in Brazil. Recently, ION geophysicists and regional petroleum geologists have begun to correlate the conjugate ties between West Africa and Brazil using data from ION's AfricaSPAN and BrasilSPAN™ seismic programs. (BrasilSPAN provides a 42,000 km contiguous dataset of Brazil's coastline.) Using these data, ION geophysicists and regional geologists have begun to identify similar petroleum systems and structural geometries as well as differences in the evolutions of the basins. These new insights are helping operators high grade their portfolios in these highly prospective regions.

APPLYING ADVANCED DATA PROCESSING TECHNIQUES

On the processing front, ION has undertaken a series of complex imaging projects in partnership with Bulwark Services, a Nigerian-based seismic data processing company. Bulwark's team brings an in-depth knowledge of the geology of the Nigerian offshore, while GXT provides the latest capabilities in data processing, converted-wave imaging, advanced geophysical analysis, and data center management.

ION and Bulwark have begun to image the data from a multi-year seabed imaging project, and early results have been promising. The improved bandwidth made possible by the VectorSeis sensor delivered higher resolution images of potential reservoir targets; deployment on the seabed reduced the problems often caused by seismic multiples; and the 4C data minimized the signal attenuation normally caused by gas clouds.

ABOUT AFRICASPAN

Since the year 2000, approximately one third of new oil discoveries have been made in Africa. To enable E&P operators to better understand the petroleum systems off the western and eastern coasts of Africa, ION's GeoVentures™ group developed a series of integrated seismic programs containing over 58,000 km of depth-imaged seismic data.

AFRICASPAN PROGRAMS

- CongoSPAN I and II – Two-phased study of offshore Angola, Congo and Gabon (~27,000 km)
- East AfricaSPAN – Offshore Madagascar, Kenya, Tanzania, Seychelles and Mozambique (~20,000 km)
- EquatorSPAN – Offshore Cameroon and Northern Gabon (~4,400 km)
- NigeriaSPAN – Gulf of Guinea (~5,000 km); Republic of Nigeria (~4,500 km)



ABOUT ION

ION Geophysical Corporation is a leading provider of geophysical technology, services, and solutions for the global oil & gas industry. ION's offerings are designed to allow E&P operators to obtain higher resolution images of the subsurface to reduce the risk of exploration and reservoir development, and to enable seismic contractors to acquire geophysical data safely and efficiently.

To learn more about how ION helps oil & gas companies and seismic contractors solve their toughest imaging and operational challenges, visit us at iongeo.com.

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