Transition Zone Acquisition
Operating in Shallow Water with Land Equipment

Opportunities for Specialized Geophysical Data Acquisition Companies in TZ Environments

Geophysical service providers with expertise in specialty seismic acquisition continue to experience long-term contract opportunities despite the current economic and industry downturn. This is especially true in resource development areas where well-capitalized national oil companies (NOCs) and international oil companies (IOCs) take a long-term strategic view of investment in order to maintain and grow their reserves. Recent activity and new contracts awarded in 2009 to data acquisition contractors with unique operating experience in both transition zone and shallow ocean bottom environments indicate that high value niche market operators can reap the benefits of investment in unique technology required to operate in such environments.

Transition zone (TZ) regions are generally described as dynamic, complex environments situated between land and deeper water. They can encompass land, fresh and salt water marsh and swamp, near shoreline, surf and tidal zones, lagoons, shallow offshore coral reefs, and deeper waters up to approximately one hundred meters in depth. These areas may require transition zone or shallow ocean bottom acquisition dependant upon the depth and environment of the survey. Transition zone seismic covers the shallow water areas from land to less than a hundred meters deep, whereas shallow ocean bottom (OBC) seismic overlaps at approximately fifty meters deep and continues to 300-500 meters in depth. Specialized vessels and equipment are necessary in either application to accommodate the appropriate water depths creating significant operational variance between the two methods, particularly in how crews deploy the equipment.

TZ acquisition systems are comprised of a variety of cable, sensor, and source technologies that bridge the gap between land and water, and are typically deployed with shorter lengths of cable for easy handling from shallow-draft vessels. These systems are flexible “make-and-break” platforms requiring rugged connectors, high tensile strength cable, and reliable packaging to protect both electronics and batteries while underwater. Line crews need to be able to safely connect the land based equipment to the shallow transition zone equipment through often hazardous surf and tidal zones. In comparison, shallow ocean bottom systems can and need to be deployed off of larger deep-draft vessels with more traditional OBC-handling systems in longer cable lengths. Cable strength requirements – thickness and weight – vary considerably from shallow to deepwater acquisition, resulting in a notable shift from easier to more difficult equipment handling by the deployment and retrieval crews.

Both acquisition methods require careful planning to mobilize personnel and equipment safely and efficiently, while accommodating complex operational and geophysical parameters. However, transition zone operation is the only water-based seismic acquisition in which contractors can successfully utilize land recording equipment in a marine environment. Conducting an integrated land-TZ survey can require multiple source and multiple receiver types on a single acquisition. Shallow OBC systems are ideal for deepwater acquisition where a single source, usually airgun, and single receiver configuration is employed. Purpose-built transition zone systems are required for the interim acquisition where land ends and shallow OBC begins creating a niche market where seasoned equipment providers and acquisition contractors achieve success.
Exploration in Transition Zone Areas a Challenge in Logistics

Transition zones are considered to be one of the harshest environments in the world to operate seismic data acquisition systems with distributed electronics. TZ acquisition is far more complicated than merely purchasing a seismic system with special underwater capacity, then dropping it in the water and shooting.

The most successful geophysical companies operating in TZ have invested considerable time and capital to purchase and rigorously maintain specialized vessels, storage containers, and deployment and retrieval equipment. They have relied upon their own ingenuity to modify equipment per the specific environmental settings that can range from swamp and marsh in muddy conditions to coral reefs with tidal surges to wide shipping channels with strong currents. In addition, environmental and legal considerations make permit, regulatory, and contractual compliance an integral part of operations, especially in fragile environments and/or protected ecosystems. These challenges are sizable barriers to entry that prevent successful acquisition for inexperienced transition zone operators. The companies with expertise in logistics and QHSE management, the understanding of local government agencies and regulations, as well as the proper type and amount of available equipment will enhance mobilization, deployment, troubleshooting, acquisition, and demobilization efficiencies.

The critical goal for a service provider in this market is to mobilize and operate equipment that is flexible and adaptable to a variety of survey parameters. Equipment utilization rates have a direct impact on the return on investment. Recording systems used for TZ operations need to efficiently support mixed-mode acquisition where source points can vary between airgun, dynamite, or vibroseis that are potentially shooting into 1C, 2C, 3C, and/or 4C receiver stations simultaneously. The more flexible the system – the more likely it is to be utilized on several projects.

A Hybrid System for Transition Zone Operations

It is not uncommon for contractors to occasionally utilize a land recording system, cables, and ground electronics in freshwater shallows at depths of up to fifteen meters. There have been a number of successful surveys in parts of South America, Russia, China, and North America using this technique. In the Barranca Liberija swamp of Colombia, a crew successfully utilized ION’s Scorpion cable-based land acquisition system with digital VectorSeis receivers to become the first-ever multicomponent survey of the area covering approximately 60 sq km of marsh environment at 8-12 meter water depths. Similar surveys have occurred in Russia and China utilizing ION’s Scorpion system with mixed airgun, dynamite, and vibroseis sources demonstrating the flexibility of using a land recording system for shallow freshwater acquisition. Although the operators were successful, this technique is not ideal in deeper transition zone areas or in a corrosive saltwater environment without increasing the risk of irreparable damage to the system and equipment.

Traditional land acquisition equipment is designed to support freshwater surveys up to 15m deep, and on occasion requires in-field modifications to mitigate the risk of equipment damage in deeper water.

When operating in either salt or brackish water ecosystems, acquisition contractors require equipment that can withstand corrosion. TZ operations are constantly pushing the depth envelope, requiring enhanced design to batteries, distributed electronics, cable-heads, and connectors to withstand compressive failure due to high water pressure. In addition, TZ equipment must be denser than water so it settles to the sea bottom where it won’t easily be dislodged by currents. In some cases the equipment may require additional weights to acquire data in areas with strong currents such as the Malacca Strait between Malaysia and Sumatra-Indonesia. Heavier, stronger cables and connectors are a necessity to withstand tensile and bending stresses introduced while distributed electronics are deployed or retrieved from the sea bottom. A single, robust system that seamlessly manages data acquisition on land and shallow transition zone is ideal for a service provider trying to increase its equipment utilization rate to achieve the greatest return on investment.

The concept is a reality for contractors utilizing the ARIES line of dual-purpose land and transition zone equipment designed by ARAM Systems, an ION Company. For over a decade, the system has been deployed in both offshore and inland transition zone acquisition in various climates, terrains, and environments around the world including offshore Africa, South America (both in the Amazon River system and offshore), Indonesia and Malaysia, India and Bangladesh, and Canada. What began as a development request from a client over 10 years ago has now become the most innovative approach to acquiring data for integrated land-TZ surveys.

The simplicity of the system is the key to its field success. The ARIES platform is a rugged recording system that utilizes standard land remote acquisition modules (RAMs) designed to fit inside a patented marine case for transition zone surveys at depths up to 75 meters. Because the RAMs can be used on both land and in water, the capital investment required on the part of the geophysical service provider is mitigated, creating opportunities for the contractor to invest in other equipment, such as a variety of sensors and cable configurations to support various survey designs. The purpose-built, water-tight
marine case houses the land ground electronics and an aluminum encased lithium-ion battery to provide an additional layer of protection while affording the crew a simplified method to charge the batteries without taking them out of the case. The ARIES marine case includes specially designed stainless steel or aluminum connectors to withstand the compressive, bending, and torsion stresses at depth, preventing damage to the most sensitive components of the acquisition system. Replaceable sacrificial anodes are placed on all marine cases to alleviate the effects of saltwater corrosion cable connectors and watertight seals.

**Positioned for Growth with Flexible TZ Technology**

Global demands for oil and gas, despite the current economic downturn, will continue to increase in the foreseeable future as countries such as India, Indonesia, and China seek ways to support increasing populations and greater energy consumption. Non-traditional seismic acquisition is becoming more prominent in areas of known reserves, and oil and gas companies are enticed by recent activities with proven results in offshore areas less than 100 meters in depth. Experienced geophysical service providers with the flexibility to mobilize personnel and equipment to projects all over the world, utilizing rugged, durable equipment such as the ARIES recording system, are poised to outperform their peers. As the economy improves and the price of oil and gas increases, those contractors with demonstrated expertise and adaptable equipment will have a clear competitive advantage in niche operations where complex surveys and difficult environments are challenging obstacles to overcome.

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