BROAD FIELD USE OF ECHO SOUNDER SYSTEMS IN CHINA

Wide Application of Multi-beam

Like the land map on land, one of the most important maps for a water region is the bathymetry chart derived from water-depth data acquired during topographic survey. Survey methodology for water depth has gone through three stages in its long history, from "point" (originally by plumb) to "line" (traditional single-beam echo sounder) to "swath" (current multi-beam echo sounder).

Single-beam echo sounders are, of course, still in current use. But they are showing a tendency to be replaced by the multi-beam echo sounders, with their evident advantages of full coverage, high resolution, high accuracy and high efficiency. During the last ten years, institutes and companies in China have imported more than fifteen sets of multi-beam echo sounders for shallow depth to full-ocean depth use, from various international manufacturers. These instruments have been widely used in various fields, including investigation of the continental shelves and Exclusive Economic Zone, offshore cable-route survey, submarine-pipe detection, seabed topographic monitoring, submarine-object detection etc. An example will be given here of each. Huge volumes of bathymetric data have now been acquired and great achievements have been made in the waters in and off China.

Topographic Survey
In the period from 1997-2002, eight institutes and companies under State Oceanic Administration, Ministry of the Land and Resources, and China General Petroleum Company joined together and carried out a key project entitled "Seabed Topographic Survey in the waters off China using Multi-beam echo sounders." During the survey, ten sets of multi-beam echo sounders were used, including Simrad EM950, SeaBeam 2112.360, Bottom Chart MKII, SeaBat 8101 and 8111. Huge amounts of water-depth data were collected and processed. Finally, detailed bathymetry charts of various waters were derived from this data. From these charts many new topographic units were discovered, such as seamounts, under-water canyons, seabed plateaux, basins on the continental slopes, and even sea mountain ranges and great valleys.

Offshore Cable Routes
Optical fibres were first introduced as submarine cables in the mid-1980s. Development of digital technologies and improvement in repeaters have since made it possible to send large volumes of signal data to faraway places. So, along with the rapid development of the national economy, submarine optical-fibre cables have developed rapidly in the past ten years in China. Several submarine cables have been laid in recent years and some are planned or are in progress within and around China. Before laying the cable on the seabed, a cable route survey has to be carried out to clarify seabed topography, geology and obstacles like the existing cables, fishing gear and shipwrecks along the planned cable route. Precise seabed topographic survey is always basic and essential, and a detailed bathymetry chart of the area within a certain width along the planned route must be derived from accurate water-depth data. Multi-beam echo sounders have been widely used in the earlier stage of topographic survey along planned cable routes.

For example, in 1997, during field topographic survey using Simrad EM950 for a submarine optical-fibre cable (SEA-ME-WE3) from Europe to Asia, a narrow and deep ditch was found along the planned route. This appeared during field topographic mapping of the East China Sea leg, off the city of Shantou in Guangdong Province and meant cable laying criteria here were not met. So we had to change the route for a new one. Re-surveying along it in the field, the ditch was found not to extend here, so the new route was adopted as the cablelaying route. Another example was the recent DA-11 submarine cable route survey near Hainan Island in the South China Sea. The pipeline on the seabed and sand ridges may be seen very clearly in this image, taken using Simrad EM3000 and processed and drawn with NEPTUNE software.

Seabed Topography
Sometimes it is necessary to monitor changes in seabed topography in order to meet marine engineering needs. With their full coverage, high resolution and high accuracy, multi-beam echo sounders have been widely used in this kind of work. For example, two seabed topographic surveys were conducted in the "complex area" of the Chengdao oilfield in southern Bohai in 1998 and 2003 using the multi-beam echo Sounder Simrad EM3000. Comparison, analysis and study of the two maps yielded important conclusions. The size of remaining mounds in the area had fallen by a ratio of 5,198m²/a, and their height by a ratio of 0.179m/a. The manmade pathway for the pipeline between Well CB20A and Central Well No.2 had widened by a ratio of...
20m/a and deepened by a ratio of 0.24m/a.

Underwater Objects
Their advantages have also led multi-beam echo sounders to be widely applied in underwater engineering and object detection. For example, the Simrad EM3000D was recently used in detection of the Lion Town, an ancient town lying beneath the waters of Qiandao Lake. Lion Town, or SuiAn, lies near Hangzhou. It was built between the Spring and Autumn Period and the Warring States Period and is full of Chinese traditional culture, cultural relics and historic sites. It was submerged by the reservoir built for the XinAnJiang Power Station in 1958 and thus the cultural relics and historic sites escaped damage in the Cultural Revolutionary of the 1960s. The ancient town has now been investigated in detail for academic purposes and tourism development. The Simrad EM3000D multi-beam echo sounder and Klein 2000 side-scan sonar system were used. Although the data is derived from different sources and reflects differing angles on features of the town, in detail the images are greatly similar.

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