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Hydrography in China

China has more than 900 lakes, some 5,800 rivers, of which five are very large, an 18,000km-long coastline and more than 6,000 islands in about 3.50 million square kilometres of sea area. All of this has to be surveyed and charted under the jurisdiction of the Chinese government. Ports are expanding rapidly and new ports are being built, also requiring an enormous hydrographic surveying effort. How is China doing this? What are the roles and responsibilities of the Maritime Safety Administration, the Chinese Navy, port authorities and surveying companies? We asked the head of the Department of Hydrography and Cartography at the Dalian Naval Academy.

Please give our readers a brief summary of your career and how you got involved in hydrography. How did you come to be appointed to your present post and what do you chair?

When I was 16-year old, in 1978, I entered the Department of Hydrography and Cartography (H&C) of Dalian Naval Academy, taking as my main subject marine gravimetric survey. In 1982 I got my BSc degree and began work as an assistant in the department. After five years, I in 1987 became a graduate student at H&C with my main research being tidal effect in hydrography. I attained my MSc degree in 1990. I continued my teaching work as a lecturer in 1991 and was promoted to become an associate professor in 1993. Then in the same year I entered Wuhan Technical University of Surveying and Mapping as a PhD candidate to research high-precision hydrographic surveying. During the two years from 1995 to 1996, I went to research high-precision bathymetry as a visiting scholar at the Department of Land Survey and Geomatics Information of Hong Kong Polytechnic University. In 1998, I finished my dissertation â€˜Space Structure and Data processing in Marine Soundingâ€™ and got my PhD degree from Wuhan Technical University of Surveying and Mapping. Then in 1999 I became a full professor at the Department of H&C of the Dalian Naval Academy; in 2000 I was appointed vice-director of the Hydrographic Surveying Corps of the Southsea fleet of the Chinese Navy. In 2001 I became Head and Chair Professor of the Department of H&C of the Dalian Naval Academy. In 2003 I published a monograph, Space Structure and Data processing in Marine Sounding; in 1993 Tidology and in 1996 Marine Gravimetric and Magnetic Surveying, both collaborative efforts. Up until now I have published more than 180 papers on hydrography.

What is the Dalian Naval Academy? What are the hydrographic or related sciences that can be studied, the courses and research: both combined military and/or civilian? How many hydrographic students study there?

The Dalian Naval Academy is a military college for the education and training of officers for the Chinese Navy, in which the Department of Hydrography and Cartography (H&C) educates and trains officers in knowledge of hydrography and cartography and the skills of hydrographic surveying and charting. This department is the only one that carries out educational work and research on hydrographic surveying and charting in China. Its training programme has been given the recognition of FIG/IHO/ICA at Category A (in 2002) and Category B (in 2003) and its syllabi are now based on Standards of Competence for Hydrographic Surveyors (9th Edition) and Standards of Competence for Nautical Cartographers (1st Edition). H&C students can obtain a BSc degree (about 50 candidates per year), a MSc degree (about twelve candidates), a PhD degree (about three candidates) or even the certificate for Hydrographers and Cartographers through various training courses every year. Often the Department of H&C trains hydrographic surveyors and cartographers for local authorities and survey companies as well.

How are surveyors trained for your navy, and how are hydrographic surveyors trained in general? Is there a shortage of trained surveyors in China? What are the prospects for the future?

In China, most hydrographic surveyors, full-time or part-time, military or non-military, have been educated or trained at the Department of H&C of the Dalian Naval Academy. There are thousands of trained hydrographic surveyors at present in China and more than 50 new hydrographic surveyors trained every year. In 1998, our department trained ten foreign hydrographic surveyors for Myanmar. As already mentioned, our training programme has obtained the recognition of FIG/IHO/ICA at Category A and B. From now on, we will train more hydrographic surveyors for China and abroad.

How is hydrographic surveying organised in China for official nautical (sea-)chart production, for military purposes, for inland river charts and port charts? And what about surveying for dredging, exploration and harbour construction projects?

In China, hydrographic surveying for official nautical (sea-)charts and for military purposes is organised by the Chinese Navy; for inland river charts and port charts it is organised by the National Ministry of Communications, for lakes charts by the National Ministry of Water Resources, and for dredging, exploration and harbour construction projects by some surveying companies.

How do you see the application of single-beam echo sounding versus multi-beam? Do you see single-beam disappearing in the future?

From the point of view of the geo-metry of marine bathymetry, single-beam echo sounding belongs to narrow-swath sounding technique, while multi-beam echo sounding is a new wide-swath sounding technique with high efficiency, especially in deep-sea areas. At present, both single-beam and multi-beam techniques are used in most developing countries and some developed countries. Undoubtedly, multi-beam echo sounding will ultimately play a dominant role in the marine bathymetry of the future, while single-beam sounding will remain as a secondary technique of sounding for a small area, especially for near-shore complex seabed.

According to the article entitled â€˜Hydrographic Surveying Technology in Chinaâ€™ in the International Hydrographic Review of April 2004, hydrographic knowledge in China is at a high level. Is this merely academic and does practise lag behind?

That article described the present hydrographic situation in China. Hydrographic knowledge in China is really at a high level. Here I would like to emphasise that practise does not lag behind academic work in China, for many academic findings have been applied in practice. It is noticeable that Chinese hydrographic surveyors are not adept at publishing their achievements in theory and experiences in practice in the English language, which may form a barrier for people outside China in terms of their knowledge of the status of hydrography within China. So I, together with my colleagues, am making efforts to publish our new research results, both theory and practice, in some international hydrographic journals, so as to make them understood and used by the hydrographic surveyors in the wider world.

Is language a barrier for hydrographic students? Are foreign documents translated or is study of the English language part of the programme?

The language is still to some extent a barrier for hydrographic students in our department, in spite of English being a compulsory course in our programme.

Is there in China a hydrographic community of scientists, surveyors and related practitioners? If so, is this community large or small? And how does this compare to land surveying?

There is a hydrographic community in China named the Hydrographic Surveying and Charting Commission; it is a branch of the Chinese Society of Geodesy, Photogrammetry and Cartography and includes fifteen commissions. The Hydrographic Surveying and Charting Commission consists of hundreds of scientists, surveyors and related practitioners from nearly 50 units. These include the Maritime Safety Administration, the Chinese Navy, the National Ministry of Communications, the National Bureau of the Ocean, the National Bureau of Surveying and Mapping, port authorities and surveying companies, etc. A yearly conference is to be held to discuss academic and applied hot topics in hydrographic surveying and charting.

What, in your view, is hydrography? Do you see it as the historic depth measurement or more, part of oceanography, of geodesy, geomatics or a separate science or activity?

In my view, hydrography is a science of underwater topography with related parameters and observations on water body. The historic depth measurement, which is similar to height survey in land surveying, is a spatial observation on the vertical parameter involved in many branches of applied sciences or social activities. But by nature it belongs to the category of hydrography.

Do you expect breakthroughs in hydrography in terms of emerging technology, new methods, higher required accuracy or anything else?

I expect there to be breakthroughs in theory and method; improvements in theories and methods have fallen behind the development of hydrographic instruments. In other words, there is a lack of enough research on plan design, mode of survey, corrections for depth and data processing in hydrography, which limits the function of instruments and causes difficulties in improving the accuracy of data. For instance, the effect of angular beam-width on depth observations, which makes depth observation smaller than its real value and distorts seabed charts, has been known for nearly 80 years. In 1996, my supervisor Professor Y. C. Chen and I gave the correction method for this effect (Corrections for the Seabed Distortion Caused by the Angular Beam-width of Echo Sounders, The Hydrographic Journal No.84, 1996). The results of our research showed that the effect of angular beam-width debases the functions of single-beam echo sounders. In addition, the accuracy of sounding data in a grid pattern can be improved by using the theory of adjustment (A Method for Detecting and Adjusting Systematic Errors of Single-beam Sounding Data Acquired in a Grid Pattern. International Hydrographic Review, Vol.5, No.1, 2004). It has been proved that theory and method play a very important role in hydrography. At present, an emergent problem is that factors on earth, discovered and not yet discovered, solved and not yet solved, limit improvement of the accuracy of hydrographic data. So I hope that there will come important breakthroughs in hydrographic theory and method.

China has developed her own Airborne Laser Sounding and Mapping System. Is this already operational and, if so, what have been the results? Is this system comparable with, for example, the Australian LADS, or does it differ?

Chinaâ€™s self-made ALSMS (Airborne Laser Sounding and Mapping System) has not yet been used in practice. Some tests show its maximum detecting depth is 36m, with 1m accuracy. The design principle of ALSMS is consistent with those made by other countries, such as the Australian LADS, of which maximum detecting depth is 50m or more.

Do you have a personal message for the hydrographic world in general and/or hydrographic surveyors in particular?

I hope IHO can explain the contents of S-44 (IHO Standards for Hydrographic Surveys) in detail, especially why Table 1 and 2 of S-44 are given and how to meet their rigorous demands. In addition, I hope hydrographic surveyors will study and improve their knowledge of error theory and data processing, which will help them accurately to evaluate their surveying data.