CSBWG CSBWG11/6/1c

Meeting 11 10 Sep 2021

Agenda Item 6.1

Proposal for Adding the Use the TCSB Data for Port and Waterway Water Depth Monitoring in the CSB Summary Guide of Harbor/Workboat

Submitted by China Maritime Safety Administration (China MSA)

SUMMARY

Executive Summary: The data accuracy requirements of the port and waterway water depth monitoring are generally higher than that of the water depth supplement application. China MSA has carried out trusted CSB(TCSB) tests in the Qinzhou Bay by harbor/workboat, the results show that the TCSB data meets the requirements of the IHO S-44 1, ENC CATZOC A1, finally achieves the purpose of port and waterway water depth monitoring and timely warning.

Action to be taken: It is recommended that the IHO CSB Working Group refer to the tests and add the use of TCSB data for port and waterway water depth monitoring in the CSB Summary Guide of Harbor/Workboat to improve and expand the applications of CSB.

Related documents: CSB Summary Guide

1. Introduction

Many successful cases such as GEBCO have played an important role in making up the water depth in the unknown sea area of the world. However, the Guidance on Crowdsourced Bathymetry (B-12) has not yet analysed or demonstrated whether CSB data can meet the accuracy requirements of the under-keel clearance (UKC) accuracy. With the development of economy,

human factors, such as frequent construction wastes illegal dumping and container overturning accidents, will affect the safety of port and waterway. Catastrophic climate will also have a great impact on the seabed or water depth of the port and waterway. The application of crowdsourced bathymetry in the water depth monitoring of port and waterway waters is an innovative and effective measure that can greatly enhance the maritime security capabilities of the maritime sector.

2. Discussion

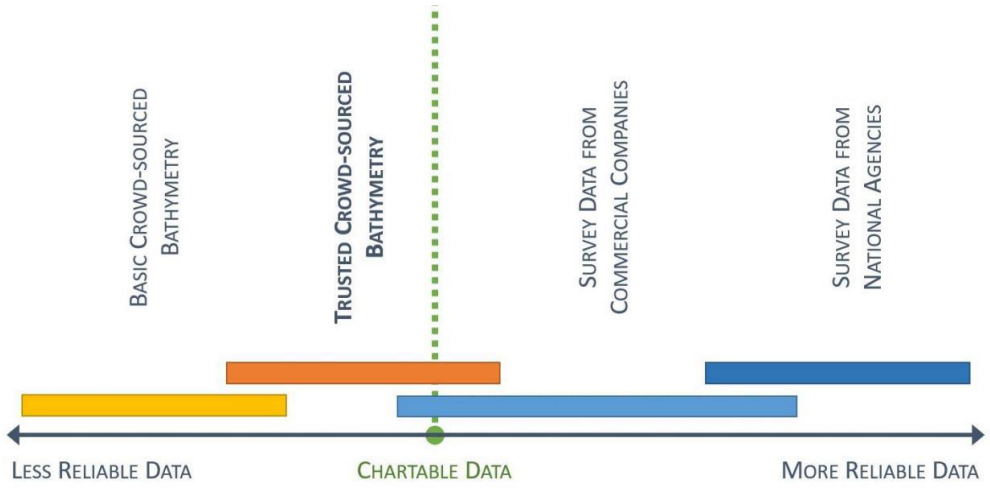

Figure 1 TCSB

The Canadian Hydrographic Service and the Danish Geodata Agency jointly proposed the TCSB at CSBWG9 in June 2020, as shown in the figure above, and believed that the increasing maturity of technology makes the adoption of TCSB achievable.

In this proposal, China MSA has completed the TCSB tests by harbor/workboat. The TCSB data meets the IHO S-44 1 and ENC CATZOC A1, finally achieves the purpose of port and waterway water

depth monitoring and timely warning.

The purpose of this test is to provide early warning in time when the water depth is found to be shallower through continuous monitoring in a small period, so as to make up for the shortcomings of the lack of current professional hydrography. Professional hydrography can also be arranged according to the requirements for the water depth shallower area that requires full coverage hydrography, and finally to provide accurate and timely official soundings to the marine user to maximize the safety.

3. Analysis

3.1 Test design

China MSA designed four different equipment configuration schemes on "Haixun1760" ship in the Qinzhou Bay from April 17 to 19, 2018. The TCSB tests were carried out, and the quality of the data was evaluated to verify the TCSB accuracy under different schemes. The configuration schemes were shown in Table 1.

Table 1 Four different equipment configuration schemes

Type	Configuration	GNSS	Echo-sounder	Date
1	Ship borne GNSS + Ship borne echo-sounder	GARMIN	NINGLU	April 17
2	Professional GNSS + Ship borne echo-sounder	Trimble SPS461 (Beacon)	NINGLU	April 17
3	Professional GNSS + Professional echo-sounder	Trimble SPS461 (Beacon)	Odom MKⅢ	April 18
4	Ship borne GNSS + Professional echo-	GARMIN	Odom MKⅢ	April 19

	sounder			

As shown in Table 1, The echo-sounder adopted the shipborne and the professional echo-sounder (Teledyne Odom Ⅲ)， the GNSS adopted the shipborne and professional GNSS receiver (Trimble SPS461).TCSB data and multi-beam data used actual collected tides and sound velocity data, as well as the same dynamic draft to correct the data. Shipborne echo-sounders and professional echo-sounders eliminated system errors, used the same CSB acquisition devices to record data, and used automatic filtering method to eliminate false water depth. Finally, the multi-beam data output grid is 2m× 2m, and the CSB data is output at the corresponding 2m intervals, and the statistical snap radius was set to 5m for difference calculation.

3.2 Result analysis

The soundings of different configuration schemes acquired by the Haixun1760 ship had been processed, and the errors of the four equipment configuration schemes within ±0.3m and ±0.5m had been statistically analysed. The results were shown in Table 2.

Table 2 Accuracy statistics results of four configuration schemes

Type	Data source	Reference soundings	Error within ±0.3m	Error within ±0.5m
1	Ship borne GNSS + Ship borne echo-sounder	Professional GNSS + Professional echo-sounder	95.4%	98.5%
2	Professional GNSS +Ship borne echo-sounder	Multi-beam	88%	96.8%

3	Professional GNSS + Professional echo-sounder	Multi-beam	91.5%	98.3%
4	Ship borne GNSS +Professional echo-sounder	Professional GNSS +Ship borne echo-sounder	97%	99.1%

In scheme 1, the ship borne GNSS was adopted, and compared with the professional GNSS, the error less than ±0.3 m was 95.4%; similarly, in scheme 4, compared the data acquired by the ship borne GNSS and the professional GNSS, the error less than ±0.3 m was 97%. It demonstrated that the positioning accuracy of the filtered ship borne GNSS is not much different from that of the professional GNSS Trimble SPS 461. The sounding accuracy of the filtered ship borne echo-sounder was comparable to that of the professional single-beam echo-sounder Odom MK III.

In scheme 2, the error less than ±0.3m of data acquired by the ship borne echo-sounder and multi- beam was 88%, and less than ±0.5m was 96.80%. The result met the requirements of the IHO S-44 1.

Compared the scheme 2 with scheme 3, in the case of using the same GNSS receiver, the error less than ±0.3 m between the data acquired by the ship borne echo-sounder and the multi-beam was 88%, and the error less than ±0.3 m between the data acquired by the professional single beam echo-sounder and the multi-beam was 91.5%. The results were consistent, which meant that the sounding accuracy of filtered ship borne echo-sounder could match with the professional echo-sounder.

The above results showed that TCSB data could meet the requirements of the IHO S-44 1, ENC CATZOC A1, and achieved the purpose of port and waterway water depth monitoring and timely warning.

4. Justification and Impacts

Shipping and offshore economic activities in certain China coast area, such as the Pearl River Estuary, are becoming more and more developed and frequent. Construction waste is often illegally dumped into the water, containers falling into the port and waterway, and disastrous climates such as typhoons, storm surges, happens now and then. The port and waterway hydrography are carried out by professional departments in traditional methods, whose work efficiency is comparatively low. China MSA has implemented and verified the TCSB test project by harbor/workboat, and got the conclusion that TCSB data can be applied to the water depth monitoring of navigable waters, and the economic cost is relatively low.

Through small-period continuous monitoring, when the sounding is found to be shallower, the passing ships will be warned in time, and the official hydrographic department will survey the relative area, so as to make up for the shortcomings of the lack of professional survey force, and finally provide accurate, timely and official sounding data, to maximize the safety of ship navigation. At the same time, based on the results of TCSB data analysis, the hydrographic cycle, and implementation plan of charts

can be further optimized, and the effectiveness of maritime hydrography can be improved.

4.Action required of CSBWG

The CSBWG is requested to:

1.Note the information provided;

2. It is recommended that the IHO CSB Working Group refer to the tests and add the use of TCSB data for port and waterway water depth monitoring in the CSB Summary Guide of Harbor/Workboat to improve and expand the applications of CSB.