

Thoughts on the future development and application of smart navigation marks

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Abstract: The intelligent transformation caused by information technology has subverted the operation mode and development direction of many traditional industries, and the shipping industry is no exception. The service has also been transformed and upgraded from the traditional visual beacon to the intelligent beacon. At present, the Beidou telemetry and remote control system has been widely used in the field of navigation support, solving the problem of monitoring navigation marks in remote sea areas, and opening a new chapter for scientific, efficient and intelligent management of the marine navigation environment. The author starts with the current situation of navigation aids management, expounds the function of "smart navigation aids", and thinks and explores the future application of smart navigation aids, so as to help the development of intelligent shipping and intelligent aviation security, continuously improve the level of navigation aid services, and ensure the navigation of ships in the jurisdiction. Safety.

Key words: smart navigation aids navigation environment navigation aid service safety

1. Contents of navigation aids management

Navigation marks refer to the positioning and navigation of ships on the way of navigation. They are a kind of infrastructure to assist navigation, and they mostly exist in some ports and waters with complex environments. Effective navigation aids management can provide important safety guarantee for ship operation. According to their functions, navigation aids can be divided into three types: visual navigation aids, audio navigation aids and radio navigation aids. The so-called navigation mark management work is mainly responsible for planning the navigation marks, reasonably optimizing the relevant configuration, and doing the corresponding management and maintenance work. Navigation mark planning is not a simple task, it needs to follow certain principles, to bring convenience to the navigation of ships while ensuring safety, to make overall plans, to consider from many aspects, to meet the requirements of urban port planning, to coordinate Other development plans, so as to formulate a scientific navigation aid planning scheme.

2. Definition and function analysis of "smart beacon"

"Smart beacon" is a broad concept, and there is no clear definition yet. The smart beacon we understand is developed from the concept of digital earth, smart earth and smart city on the one hand; on the other hand, it comes into being from digital port and shipping, port and shipping informatization and smart port and shipping.

The "smart beacon" should have obvious "high-tech", "multi-function", "Chinese core" and other intelligent beacon characteristics, equipped with Beidou positioning, visibility meter, weather meter, Doppler current meter, wave meter, electronic compass acceleration Instruments, control box systems, power supply systems, cameras and other equipment can monitor the marine environment of the waters and the surrounding bridge waters in real time through the mobile APP, and provide hydrological and meteorological data for maritime supervision and

navigation support AIS, VTS, CCTV and other supervision systems, so as to avoid To avoid or overcome unfavorable meteorological and hydrological conditions, the navigation of ships is safe, time-saving, and economical. Passenger ships will be more comfortable, and the losses caused by disastrous weather will be minimized, and the navigation management capability will be further improved. "Smart beacons" include but are not limited to the following:

2.1 Moving beacons

A moving buoy is defined as a non-fixed, unmoored buoy, but does not include a fixed or moored buoy that drifts from its original position. At present, mobile beacons are divided into two categories, physical mobile buoys and virtual mobile AIS virtual beacons. Mobile navigation aids are mainly used for the following purposes:

2.1.1 Ocean Data Collection System (ODAS)

This kind of mobile buoy can be used for ocean and tidal research, and can be thrown with the ship in areas such as dangerous weather routes, shallow water areas, and shipwreck-prone areas. It can drift along the route of dangerous weather conditions and can be observed effectively. Data such as wave height, wave period, temperature, air pressure, etc., are communicated by satellite (iridium) communication and CDMA/COMM at intervals of 20 minutes. The main application scenarios are as follows:

2.1.2 Search and rescue

Mobile buoys can be used for the search and rescue of drowning persons, and search for missing persons by tracking the floating direction and trajectory of the buoys for several hours.

2.1.3 Monitoring water quality, pollution and tracking hazardous objects

The mobile beacon can be used to track marine pollutants and fixed target trajectories at sea.

2.1.4 Marking the sunken ship

The floating wreckage can be marked with a mobile beacon, and the floating trajectory of the wreckage can be marked and salvaged. At present, ARM has formulated recommendations on the use of mobile navigation aids, and the guidelines on the use of mobile navigation aids are still in the process of formulation.

2.2 Intelligent buoy service

The intelligent buoy system is an autonomous system composed of different electronic modules, which use special software to realize the management function of the operation of the buoy. The main purpose of the smart buoy system is to provide the enhanced features of the beacon only when the vessel really needs it. This can greatly save energy.

To achieve this, first the smart buoy system must be able to detect (via AIS signals and dynamic parameters) ships entering a predetermined area. When a ship is detected, the system triggers enhanced beacon features (such as high-power lights or radar boosters) at specified times. Smart buoys can provide real-time hydrometeorological and other information support for ship navigation and port entry operations. It is able to calculate which ships are bound to come into port and optimize its own beacon functions (lights/radars/short messages) based on these analyses. Ability to interact with local VTS or port authorities.

2.3 "Electronic Fence" Intelligent Service System

Through the movable electronic fence algorithm, the electronic fence is automatically updated according to the direction of movement of the calibration object and the data update cycle. In the aspect of ship navigation and navigation, multi-language and multi-mode automatic

broadcast of warning text and voice information is realized. The system expands the potential functions of AIS, and is a beneficial exploration in the implementation of "E-Navigation" and the realization of "Intelligent Aviation Insurance". A maximum of 50 virtual navigation aids can be broadcast, and the transmission power can be adjusted to ensure the coverage needs and avoid interfering with surrounding ships, resulting in redundant navigation information; using AIS time slot reservation technology to solve the problem of time slot conflicts outside the coverage of AIS shore base stations, to ensure that the system can effectively broadcast virtual AIS navigation aid information in both the waters covered by the AIS shore base station and the waters not covered by the AIS shore base station.

3. Thoughts on the application of "smart beacon" in Wenzhou jurisdiction

At present, China has piloted smart navigational beacons in some sea areas, such as the police No. 7 light buoy set up on the Hong Kong-Zhuhai-Macao Bridge. Equipped with Beidou positioning, visibility meter, weather meter, Doppler current meter, wave meter, electronic compass accelerometer, control box system, power supply system, camera and other equipment, it can monitor the marine environment of the Pearl River Estuary waters and surrounding bridge waters in real time through the mobile APP Environment, it will be connected to the Maritime Safety Administration AIS, VTS, CCTV and other supervision systems to provide hydrological and meteorological data, and further enhance the ability of ship traffic management. In the future, ships entering and exiting the waters of the Pearl River Estuary will be able to know the effective hydrometeorological data in real time through the mobile phone APP or website, so as to avoid or overcome unfavorable meteorological and hydrological conditions, making the navigation of ships safe, time-saving and economical. Passenger ships will also be more convenient. Comfort and minimize damage due to severe weather. The 6 existing navigation aids of the Qiongzhou Strait ship alignment system have also begun to carry out pilot construction of smart navigation aids. Anemometers, current meters, visibility instruments, and video monitoring systems have been deployed to further improve the intelligence level of navigation aids and enhance the ability to support navigation.

The characteristics of navigation conditions in the Wenzhou area: the sea area is large, the port area is scattered, there are many islands and reefs, and there are many connecting pipelines between the islands, including submarine cables and overhead cables; There are north-south waterways and east-west waterways entering and leaving the port area. There are both cargo routes and passenger routes. There are many routes crossing, large and small ships are mixed, and the navigation density is high; the channel has many turns, and the turning angle is large; , the overall navigation conditions of ships are relatively complex, and there is a great demand for "smart navigation marks", which can be mainly used in the following aspects:

3.1 Can be applied to the starting point of important fairways

Taking the Wenzhou area as an example, the current important material transportation channels include the Yueqing Bay inbound channel and the Cangnan China Resources Power Plant inbound channel. The entry channel of Yueqing Bay is about 45 kilometers long, which can meet the requirements of 100,000-ton bulk carriers entering the port by tide and leaving empty, and 50,000-ton container ships two-way navigation by tide; the entry channel of Cangnan China Resources Power Plant, The main purpose is to provide coal transportation services for China Resources Power Plant. The waterway of the power plant is 17.4 kilometers long and can meet the navigation requirements of 35,000 tons of ships. Due to the particularity of the entry channel

of Yueqing Bay, no large-scale navigation aid signs are currently set at the starting point of the channel outside the mouth of Yueqing Bay, and Cangnan China Resources Power Plant has to be dredged every year because its channel belongs to the dredging channel, resulting in light buoys often being towed and displaced by dredging ships. If the "smart beacons" are used in these two channels, the existing problems can be effectively solved.

3.2 It can be applied to the key channel of Oujiang Estuary

The Oujiang estuary channel is divided into the inner channel of the Oujiang estuary and the outer channel of the Oujiang estuary with Qitou as the boundary. According to the "Special Plan for Waterway and Anchorage of Wenzhou Port", the waterway of the north mouth of the Oujiang River starts from Qitou and is open to navigation along the deep water area between Gaosha Shoal and Lingkun Shoal, and then turns to Xiawuxianzui of Damen Island and the south side of Qingling Island. Connect to Qinglingyu anchorage. The southward channel of Oujiang River: This channel starts from the North Waterway of Oujiang Estuary and sails along the Lingkun Shoal to the waters on the south side of Chongshansha. It is the main channel for small ships from Wenzhou Port to Dongtou Island, Zhuangyuanao Island and Nanji Islands. Due to the importance of this channel, it can be considered to set up a "smart beacon" at the gate of the Oujiang River, so that ships can grasp relevant navigation-aiding information in a timely manner, and provide diversified information services for ships entering and leaving their voyages.

3.3 Can be applied to maintain difficult sea areas

The offshore wind measuring tower is a new type of tower that is used for data collection of wind resources. The wind measuring tower is erected in the target wind farm to analyze the actual situation of wind energy resources in the wind farm. At the initial stage of construction and operation period, corresponding navigation aid signs are set up for the offshore wind towers. However, because the offshore wind towers basically rely on the open waters, the swells are large, and the maintenance is extremely difficult. The beacon is set on the platform of the wind measuring tower. The platform is more than ten meters above the sea level. Maintenance personnel have to climb a ten-meter-high fence to reach the platform, which poses a great safety risk. If the "smart beacon" is applied to the sea area of the wind farm, the real-time sea conditions of the sea area can be known in advance, and the inspection and maintenance tasks can be reasonably arranged. "Electronic fence" can identify fixed offshore wind farms, and can "track" to identify prohibited navigation areas according to the location of large-scale dynamic breeding cages at sea, so as to ensure the navigation safety of surrounding ships.

4. Conclusion

"Smart Navigation Aid" is a technological change in the navigation aids, inspection methods and maintenance methods of navigation aids. It is not only the application of a new generation of information technology, but a comprehensive development model of navigation aid services in many fields, including the information infrastructure of navigation aids. improvement, in-depth application of emerging information technology, comprehensive informatization of management and services, substantial improvement of personnel technical level, increase in investment in technological innovation and informatization construction, recognition of the development model of smart navigation assistance services, and construction and development of smart port soft environment. constantly improving. The application of "smart navigation marks" is an important measure to implement the concept of smart transportation and improve the level of data, informatization and intelligence of waterways. It is of great significance to speed up the

construction of smart transportation and optimize the business environment of ports and shipping.

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