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Research on Application of Electronic Chart Display and Information System in Pilotage

Guanchao Jiang[1]

[1]Merchant Marine College, Shanghai Maritime University, Shanghai 201306, China.

Abstract

Water transportation has the advantages of strong versatility, large transportation capacity, long average transportation distance and low freight cost. It is an important form of transportation in my country, and it bears more than 90% of my country's foreign trade cargo transportation. To ensure the safety of transportation, ships carrying cargo must be operated by port pilots when entering and leaving the port, berthing and leaving the berth. With the widespread application of modern information technology in ships, pilots should make full use of advanced electronic charts and information system equipment when piloting ships, and comprehensively use the information provided by the equipment to better ensure the safety of navigation. Safe water transportation has played a huge role in promoting my country's development of international trade.

Keywords

Ship; Pilotage; ECDIS.

1. Introduction

The electronic chart display and information system(ECDIS) is a very useful and reliable navigation aid system for ships when navigating at sea. It can not only display all chart elements and information completely, but also provide ships with various navigation-related Navigation information.

Compared with traditional paper charts, ECDIS has obvious advantages in many aspects: ECDIS can use computer technology to automatically process and display the charts according to people's actual needs, such as the hierarchical display of chart information and chart roaming Display, zoom display, automatic splicing and fast display of multiple charts, etc.; ECDIS can display the required part of the chart information according to people's requirements and hide the unnecessary information; in addition to displaying the chart information, ECDIS It can also reduce the burden of ship pilots by providing functions such as route design, ship position display, track playback, and alarm; ECDIS can also be connected with navigation equipment to realize the fusion of chart information and navigation information, which is for the safe navigation of ships and ships. Avoid collisions to provide powerful help.

2. Risk Analysis based on the Pilotage Process

Through statistical analysis of the safety of ship pilotage, maritime affairs involving ship collisions, groundings, and dock contact during ship piloting operations, including various accidents that objectively cause losses, and incidents that pose threats or hidden safety hazards to operational safety The probability is higher.

From the point of view of the piloting process, the piloting risks from high to low are: channel navigation, berthing maneuver, off-berth maneuver, anchor maneuver, and U-turn maneuver. The navigation time of a ship during piloting is long, and the risk of navigation in the channel is the greatest; while other operations, such as berthing and unberthing, are relatively short, but the time period and probability of accidents are more than three times that of other ships.

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From the perspective of accident types, the piloting risks from high to low are: collision, contact damage, grounding, loss of control and others. With the widespread use of ship positioning equipment and the improvement of port traffic management, grounding accidents are no longer the main source of ship risk.

If the comprehensive risks are considered, the data shows that the following risks are high: ①The risk of accidents caused by small boats when navigating in the channel; ②The risk of accidents touching the moored ship or dock due to improper avoidance when navigating in the channel. The navigation conditions of the port and the navigation operations of other ships have deteriorated, and have seriously affected the safety of ship piloting. Especially due to the needs of port and urban construction and development, in addition to the large increase in the number of large ships entering and leaving the port, it is even more difficult to count. Small ships carrying construction materials such as yellow sand, stones, etc., sailing in accordance with the regulations, navigate disorderly in the port channel.

Through the above analysis, it can be seen that there will be risks in every link of the ship's pilotage process, and the risks may come from human factors, environmental factors or equipment factors, etc. According to statistics, with the widespread use of ship positioning equipment on ships, ship grounding accidents have been effectively curbed. This, on the other hand, shows that the advanced equipment and technology put into operation play a very important role in reducing ship pilotage accidents.Electronic Chart Display and Information System (ECDIS) is another great technological revolution in ship navigation after radar/ARPA. It has developed into a new type of ship navigation system and auxiliary decision-making System. With the gradual completion of official electronic charts (ENC) of various countries, the emergence of standard ECDIS and the recognition of IMO, ECDIS will be able to completely replace paper charts in the next few years and become a comprehensive processing method for navigation information in the 21st century. In the process of piloting If the ECDIS can be used correctly and proficiently, the prevention and control of pilotage risks will reach a new height, and the safety of pilotage will be greatly improved.

3. Application Research of ECDIS in Pilotage

This main research is based on the risk analysis of the pilotage process. The pilotage process is divided into the following five aspects: channel navigation, berthing and unberthing maneuvers, anchor maneuvering, collision avoidance and emergencies, etc. The detailed description of ECDIS Application in pilotage.

3.1. Application of ECDIS in Navigation

The navigable waters of the channel are usually restricted by geographical environmental factors. The width of the navigable waters is extremely limited, the navigable density is high, sudden weather and poor visibility, etc., bring great difficulties to port piloting operations. In the era without ECDIS, the pilot relied on the naked eye, telescope and radar. When visibility is poor, relying on the naked eye is not enough, relying on telescopes is limited, mainly relying on radar. Pilots generally rely on experience to judge the position of the navigation mark from the radar image. With ECDIS, the ship's position, navigation mark, and shoreline are clearly marked on the electronic nautical chart. Its image is not disturbed by the outside world. It takes a short time for the pilot to know the position of the navigation mark and the ship's position. In this way, the pilot can focus more on maneuvering and avoiding collisions.

3.2. Application of ECDIS in Ship Berthing and Unberthing

ECDIS can not only provide existing data such as the current speed of the ship over the ground or over the water, but also can predict the ship's position. With the function of ship position prediction, the pilot can easily control the speed of the ship, laying a solid foundation for the

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next berthing. ECDIS can superimpose the ship's trajectory line on the ship's headline, so the movement of the ship seen on the electronic chart is changing along the trajectory line. If the ship's arrival direction and arrival span are marked on the electronic chart before arriving at berth, and then the trajectory is superimposed, the pilot only needs to make the ship shape displayed on the ECDIS follow the pre-designed trajectory when manoeuvring the ship. Go, you can control the ship's position well.

In addition, the approach angle refers to the angle of intersection between the ship's heading and the berth, which determines the contact area when the ship approaches. ECDIS can also provide an intuitive reference for the pilot. After entering the docking process, the operator can enlarge the scale of the electronic chart to clearly see the dock, and then use the method mentioned above to superimpose the heading from the compass on the ship's first line, so that The close angle can be observed very intuitively on the chart. The approach speed refers to the normal speed of the ship docking, and its magnitude determines the impact force generated when the ship is attached to the berth. When using ECDIS to assist in berthing, the heading from the compass is superimposed on the ship's fore and aft lines. At this time, the ship shape displayed on the electronic chart represents the state of the ship in geographic space. Since ECDIS can display the ship's heading and trajectory at the same time, a trajectory vector pointing to the pier represents the ship's lateral speed. The pilot can judge the ship by referring to the angle between this vector line and the pier. Whether there is a longitudinal speed or a lateral speed, the ship is operated according to the information provided by ECDIS.

3.3. Application of ECDIS in Anchoring Operation

In anchoring operations, anchoring positioning is the most concerned issue for pilots in anchoring operations. Unlike the dock, which has a fixed target reference, there are many factors that affect the anchoring operation, such as the empty position of the anchor position, the ship swaying after anchoring, Swing and so on. At this stage, the anchorage divisions of many ports can be said to be interspersed, dozens of large and small, and many anchorages are set on the channel or the side of the channel. VTS has strict requirements on anchoring positioning, and pilots have very little choice in anchoring operations. It is very important to drop the anchor. After using ECDIS, the pilot can display the ship's electronic chart according to the display of the ship, especially the ECDIS can display the ship's shape according to the scale. The operator can confirm the position of the ship at any time, and the anchor position determination and anchoring operation become fast and accurate, thereby improving the navigation Staff's work efficiency.

3.4. Application of ECDIS in Ship Collision Avoidance

ECDIS can superimpose and display the radar image, radar tracking target and AIS report target information on the electronic chart, providing the positional relationship between the own ship and the dynamic target around the ship. Mariners can judge the collision avoidance situation and make collision avoidance decisions based on this. At the same time, the feasibility of the collision avoidance decision can be detected on the electronic chart.

For surrounding ships, when the CPA of the nearest encounter point and the TCPA critical value of the nearest encounter time are set, ECDIS will calculate the encounter situation with the own ship one by one according to the navigation status of the own ship and all other target ships. If an urgent situation is reached, that is, when CPA and TCPA enter the set threshold at the same time, a warning message will be given. The navigator conducts correct analysis of various information and status, and makes correct collision avoidance countermeasures. Through ECDIS testing, the feasibility of collision avoidance countermeasures is determined, the quality of ship piloting is improved, the occurrence of collisions, rocking and other accidents are reduced, and the navigation safety of ships is improved. For dangerous objects, such as shipwrecks, obstacles, and signs on the water (buoys, buoys, etc.), the judgment can be based

on the distance from the route. In the piloting operation, the route is fixed, and it can be judged whether there is danger on the ESDIS by the degree of deviation of the dangerous object and the ship from the center line of the route. The radar with ARPA function can calculate the CPA and TCPA of the own ship and the target ship. These two items are displayed on the radar screen in digital form, but they cannot display the relative position of the two targets at the nearest time. ECDIS can display the two objects very intuitively. The relative position of the ship at the nearest time provides an expected result for the pilot's manoeuvring and avoidance actions, thereby making the pilot's decision more accurate. The use of ECDIS reduces the occurrence of reckless actions to a certain extent, avoids the formation of an urgent situation to a great extent, and is forward-looking.

3.5. Application of ECDIS in Pilotage to Deal with Emergencies

Unexpected events cannot be avoided during the piloting process. For example, the emergence of severe weather. Due to global warming, sudden weather such as thunderstorms and strong winds occur from time to time, and the coming and going is fierce, coming and going in a hurry, which has a great impact on ships in navigation. When the ship was suddenly hit by a thunderstorm while sailing, the pilot felt like a rain curtain was drawn. Sometimes the bow of the ship could not be seen with the naked eye. The radar screen was covered by rain echoes, navigation marks, ships, and shores. The line was completely submerged, and the radar lost its navigational aid. At this time, ECDI S has its magical powers. It is not affected by any weather. The navigation mark, ship position and water depth are clearly displayed. As long as the pilot corrects the ship's position in time and adjusts the appropriate diversion pressure difference, it can ensure that the ship is sailing in safe waters. In the spare time after piloting is over, the track record in ECDIS can be replayed, and the whole process of piloting operation can be replayed and analyzed, and gradually from qualitative operation to quantitative operation.For emergency situations where people fall into the water, ECDIS has MOB virtual and physical buttons according to IMO regulations. The pilot can operate the MOB button, combined with the search and rescue function in ECDIS, quickly plan the search and rescue trajectory, and conduct a reasonable search and rescue. During the search and rescue process, judgments can be made based on the trajectory to shorten the search and rescue time.

4. Conclusion

The application of ECDIS in the field of pilotage has indeed brought convenience to the pilot's work, and its role will be reflected in reducing maritime accidents. Pilots should have a comprehensive understanding of ECDIS's operating mechanism, master its performance, and be familiar with its functions and correct use methods; should also accurately understand ECDIS's own weaknesses and possible problems, and make full use of the formal lookout and independence in the process of manoeuvring. The methods and methods of ECDIS have tested its effectiveness, rationality and accuracy, and have fully utilized its functions, avoided the occurrence of risks, and truly achieved its purpose of promoting navigation safety. At the same time, pilots should learn solid piloting technical knowledge, master excellent ship handling skills, and continuously improve their own piloting business level, combined with the use of ECDIS, to complement each other and take a new step for safe piloting of the port.

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