

The Impact of the Development of Intelligent Ships on the Future Crew Construction

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Abstract

Based on the research and analysis of the phenomenon that the number of Chinese seafarers has decreased sharply in recent years, it is found that the seafarers structure in China has obvious regional characteristics, and the rate of seafarers turnover has a great restriction on the construction of the national seafarers. According to the current development trend of shipping industry and intelligent ships and the current situation of domestic crew construction, it is found that China may face the serious problem of crew reduction in the future, and therefore the composition of the crew will also change accordingly. In view of the above problems, the training objectives and evaluation methods of crew members must also be improved to meet the future development trend of the shipping industry. Therefore, it is suggested that the school should make timely adjustment to the training target and evaluation method of seafarers according to the trend of intelligent ship development, and actively advocate the cultivation of interdisciplinary talents.

Keywords

Crew ,crew training ,intelligent ship ,inter-disciplinary talent.

1. Introduction

The 18th National Congress of the CPC reaffirmed the "Two centenary goals" and, for the first time, put forward the strategies of building China into a maritime power, calling on the whole society to pay more attention to manage the ocean, so as to continuously make new achievements in building China into a maritime power.

As fresh force in national economic construction and pioneers in maritime development, seafarers are an important force in building a maritime power. The implementation of the strategies of maritime power and the development, utilization, protection and control of the sea are inseparable from the crews. The crews are valuable assets to promote the development and progress of China's society, reserve force of the Navy, and guarantees for the foreign side's own hard power in the competition of great powers. This paper analyzes the development status of China's crew construction in recent years and the development process of intelligent ships proposed by domestic experts and scholars, explores the impact of the development of intelligent ships on the construction of crews, and puts forward personal opinions to promote the development of future seafarers.

2. The Era Characteristics of the Development of Our Country's Crews

2.1. China Is Nation with Large Crew Numbers

Since the reform and opening up, with the rapid growth of China's internal and external trade, shipping has played an increasingly important role in China's economy and achieved unprecedented development. China has become a world port power, shipping power, container transport power and the second largest economy in the world. According to the crew Development Report 2019, by the end of 2019, the total number of registered seafarers in China

was 165,9188, with a year-on-year increase of 5.3%. Among them, the number of seafarers was 78,4355, with a year-on-year increase of 6.3%. The number of crew members of international sailing ships was 57,5823, up 5.5% year on year, including 38,227 women. Last year, 155,000 sailors were sent abroad, up 6.5% year on year. The crew remains stable on the whole.

2.2. The Crew Structure Is Relatively Reasonable

It can be clearly seen from Figure 1 that the crew engaged in international navigation presents a younger distribution: the age of third mates and fourth engineers are concentrated in 25-30 years old; first officers and the second engineers are distributed in the age range of about 35; captains and chief engineers are concentrated in the age range of about 45. The development trend of younger crews have some advantages in that new blood constantly comes into the crew team, which adds vitality to the construction of crew team in the new era. But at the same time, the number of young international crew fluctuates greatly, and the stability of the team structure is slightly poor.

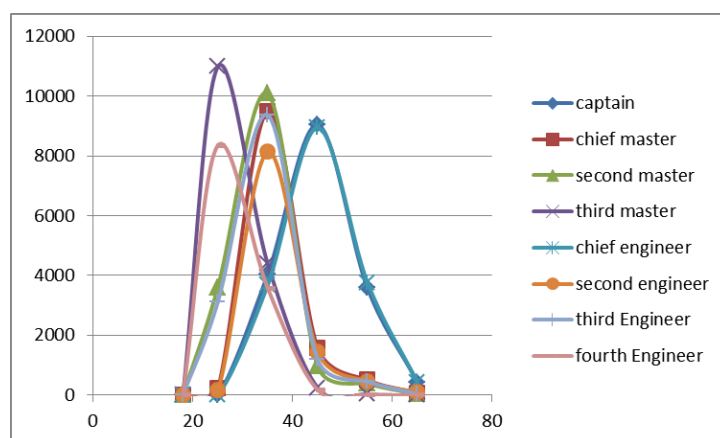


Figure 1. Age distribution of crew members holding certificates of competence for international voyages

Figure 2 age distribution of senior officers in coastal navigation area. Compared with international navigation crews, the age distribution of senior officers in coastal navigation area is relatively large and the number of officers is small. There is a shortage of supply of young crew members. Compared with the international seafarers, the number of seafarers at all ages changes more slowly, and the coastal seafarers are more stable.

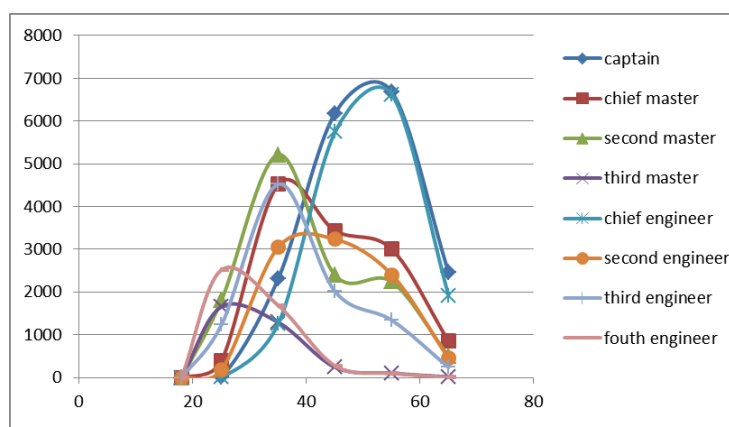


Figure 2. Age distribution of crew members holding a certificate of competency for coastal navigation

2.3. The Crews Is Stable but Lacks Motivation for Subsequent Development

As of the end of 2019, china had 259,466 seafarers holding certificates of competence for international voyages increased of 3.8%. However, the development of the young crew team is unstable and the drain is large: according to Table 1 , from the perspective of the change in the number of third mates and fourth engineers from 2018 to 2019,the number of license holders in third mates has decreased by 18.0% year-on-year. The number of fourth engineer license holders dropped by 19.0%, the number of active third officers dropped by 20.7%, and the number of active fourth engineers dropped by 23.3%. The number of third mates and fourth engineers' ships dispatched to international voyages in the unlimited navigation zone decreased by 26.5% and 25.4% year-on-year. The number of third crew members of coastal ships decreased by 13.8%, the number of fourth engineer decreased by 14.4%, the number of active third crew members decreased by 14.1%, and the number of fourth engineer members decreased by 15.0%.

Table 1. 2018-2019 young crew team

position	Number of card holders	Number of active people	Number of assignments
The third officer in 2018	22914	16575	7604
Fourth Engineer in 2018	20336	14455	6405
The third office in 2019	18952	13342	5594
Fourth Engineer in 2019	16718	11421	4772

2.4. The Follow-Up Supply of Seawall Crews Is Worrying, Which Should Be Attached Great Importance by Relevant National Parties

As shown in Table 2, from 2015 to 2019, the enrollment of seafarer training and education institutions has been hovering around 15,000 to 18,000 for a long time. The enrollment score of seafarer training and education institutions continues to decline, and the quality problems and the subsequent comprehensive quality requirements of the seafarer team face challenges. It takes three to four years for China to train a group of maritime technical talents. The proportion of graduates who choose to go on board ships has been declining continuously, and at present it is basically around 30%. As for the proportion of seafaring graduates going on board ships at present, as shown in Table 3, the loss rate of seafaring graduates seriously affects the subsequent supply and development of seafaring crew. At the same time, considering the source of students and employment of seafaring graduates, the country and relevant parties pay attention to it and improve the professional attraction of seafarers.

Table 2. 2015-2019 seafarer education and training institutions enrolled in maritime majors

professions	Enrollment				
	Year of 2015	Year of 2016	Year of 2017	Year of 2018	Year of 2019
Driving professional	8193	8229	6844	9248	10536
Marine Engineering	6767	7106	5959	7750	8328
Total numbers	14960	15335	12803	16998	18864

Table 3. 2017-2019 part of the proportion of graduates from maritime colleges on board

Number	Graduated in 2017	Graduated in 2017	Graduated in 2017
	Active number/ Number of graduates	Active number/ Number of graduates	Active number/ Number of graduates
1	398/1014	340/987	370/1340
2	378/1211	318/1121	420/1315
3	228/733	170/725	427/1258
4	310/921	299/937	282/1046
5	212/635	203/656	248/1027
6	95/338	213/685	190/618

3. The Impact of the Development of Smart Ships on the Crew Building

Unmanned navigation is an inevitable trend of intelligent ships. Ma Qiang et al. [1] pointed out the general development direction of intelligent ships in each stage: the first stage is to realize autonomous perception of ships; the second stage is the construction of semi-autonomous decision-making ships; the third stage is to realize autonomous decision-making ship and intelligent unmanned ship in the final mature stage. In addition, during the development of intelligent ships in the above three stages, the number of people on board also changed accordingly. Qi Bin [2] pointed out the specific requirements of various positions and corresponding responsibilities and capabilities in the shipping industry during the development of intelligent ships, as shown in Table 4 below.

Table 4. Position configuration table required for the development stage of smart ships

progression stages	Position Titles	Job Responsibilities
Transition stage of smart ship development	Shipboard jobs	Routine maintenance and emergency repairs of ship equipments
The mature stage of smart ship development	Shore-based jobs	Responsible for the remote control of the ships
	Port quick repair posts	Responsible for the rapid maintenance of ships

3.1. Changes of Crew Responsibilities

According to the investigation and statistics of maritime accidents, the proportion of ship traffic accidents caused by human factors accounts for about 80% of the total number. The development of intelligent ships is to further guarantee the safety of ship navigation, reduce the occurrence of maritime accidents and avoid casualties and cargo losses caused thereby. According to the requirements of STCW Convention, the purpose of traditional maritime education is to train Marine transportation talents, including pilots, engineers, electronics and electricians, etc. In the transitional phase of the development of smart ships, the responsibilities of on-board staffs include the daily maintenance of the equipment on board and the conduct of emergency work. In the mature stage of intelligent ship development, the requirement for crews are changed to be responsible for remote controls of the ships. The seafarers are not only required to have professional navigation knowledge and rich navigation experience, but also required to have relevant computer knowledge and data analysis ability when operating the ship remotely. It will be a great challenge for students who have learned a lot of traditional sailing techniques and seafarers who have been sailing for many years.

3.2. Changes in Crew Compositions

Duan Zunlei et al. [3] pointed out that the main goal of future crew training is to cultivate a crew that can better adapt to the development trend of ships and the transformation of ship transportation methods. The crews of our country mainly come from graduates of professional sailing colleges and training centers. It can be seen from Figure 3 that during the training of senior crew members, from undergraduate to technical secondary school students, the passing rate of the competency examination decreases successively. Undergraduates have passed systematic navigation professional knowledge learning in school, with good cultural foundation and quality. High level of professionalism is the backbone of shipping, maritime and ship management, while the basic cultural level of technical secondary school students is relatively low. Retraining may be able to adapt to the requirements of traditional navigation, but for intelligent navigation in the mature stage, It is difficult to meet the requirements.

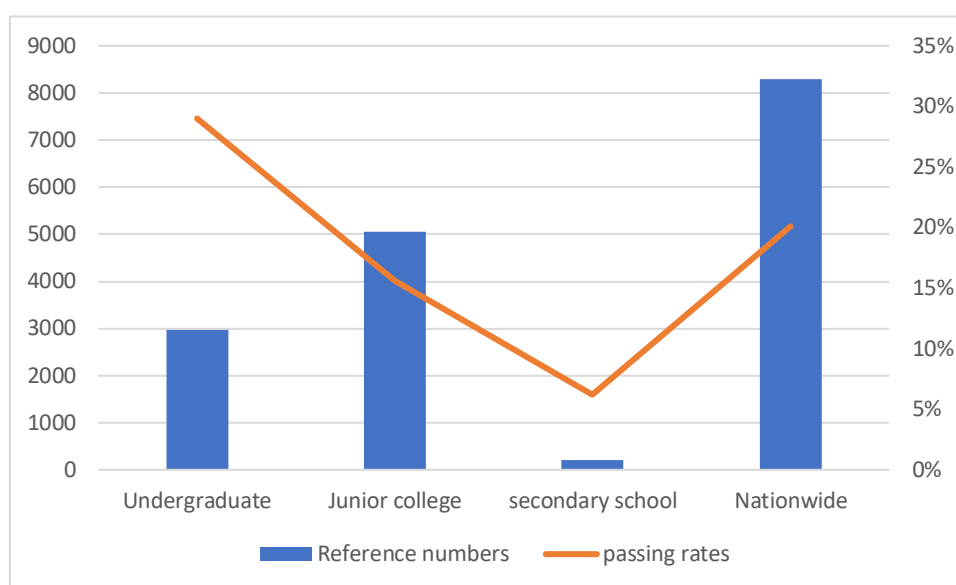


Table 3. Comparison of the passing rate of the preliminary examinations of the national maritime professional colleges and universities in 2018

3.3. Changes in Crew Training Direction and Competency Assessment System

The development of intelligent ships has put forward new requirements on the training objectives of seafarers. The seafarers' assessment rules in different periods have different requirements on seafarers' competency, as shown in The content of crew evaluation examination is to gradually transition from pure theory to theory plus practical operation. In the future, in the era of intelligent navigation, large, professional, intelligent and other high technology content of ships are constantly emerging, which puts forward higher requirements for the comprehensive quality of the crew. Therefore, the rules of crew evaluation should also keep pace with The Times.

4. Opinions on Future Crew Construction

4.1. Future Development of the Crew And Crew

The biggest impact of smart ships on crew is the reduction of the number of crew on board and the change of their responsibilities, which means that a group of crew members who cannot adapt to the development of smart ships will be eliminated. For individual seafarers, they should timely understand the development process of intelligent ships, actively expand their personal career development space, and grasp the impact of intelligent ships on their career

development. For the crew construction, it is necessary to actively cater to the trend of intelligent ship development. We clearly know that intelligent ships will bring great convenience to ocean transportation and reduce the possibility of maritime traffic accidents. Therefore, it is necessary to conform to the trend of intelligent development and cultivate a high-level and high-quality crew.

4.2. Suggestions on Crew Training Program

Intelligent ship pilots need to have knowledge and ability in operation, management and monitoring of intelligent ships [4]. Domestic maritime colleges and universities should strengthen exchanges and cooperation with seafarers training institutions around the world, timely adjust training plans, formulate seafarers training programs for the development of smart ships in different periods, and update corresponding courses and teaching materials. The school can also strengthen the communication with the Maritime Safety Administration, fully consider the crew's duties in the transition period of the ship's intelligent development, and establish a new evaluation method according to the specific situation. In addition, as an exporter of seafaring talents, the university should also cooperate more with ship enterprises, rationally consider the demand for seafaring professionals in the ship market, and further optimize the crew training program.

4.3. Training of Maritime Composite Talents

Lu Mei et al. [5] mentioned that IAMU considered computing and Informatics as a major knowledge factor affecting the long-term development of seafarers in its "Global Maritime Professional Knowledge System". Intelligent ship requires the crew to use big data processing technology to analyze the ship's own status, Marine environment, port and other necessary information during the ship's voyage, and combine with their own rich navigation knowledge to operate the ship remotely. Computer technology will also play a more and more important role in the navigation of ships. As the exporter of talents, navigation colleges and universities should strengthen students' understanding of intelligent ships according to the needs of the development of intelligent ships. At the same time, special courses, such as maritime data analysis, may also be set up in the seafarer training centre for seafarers to further their studies. In addition, all parties should jointly improve the professional attraction of seafarers and attract professional talents from all sides to join in the training program of maritime composite talents, so as to make contributions to the training of new generation of maritime composite talents with their advantages.

5. Conclusion

Countries all over the world are committed to the research of intelligent ships, I believe that soon, the era of intelligent ships will come, the impact on the development of crew will come as expected. In order to better meet the arrival of the era of intelligent ships, seafarers should always pay attention to the development trend of intelligent ships, maritime colleges and universities should timely adjust the training program, maritime Safety Administration should also optimize the evaluation method, promote the development of the shipping industry, and make a contribution to the building of a maritime power.

References

- [1] Ma Qiang, Liu Gang, Zhao Enrui, et al. The reform of the training mode of navigation professionals for smart ships[J]. Maritime Education Research, 2019, 36(001):24-29.
- [2] Qi Bin. Intelligent ships are gradually approaching [J]. China Ship Inspection, 2015, 000(001): 92-94.

- [3] Duan Zunlei, Li Ye, Liu Jinjing. The characteristics and countermeasures of the development of Chinese seafarers in the new situation[J]. Maritime Education Research, 2018, 35(04):7-12.
- [4] Wu Zhaolin. Development of unmanned ships and navigational education countermeasures[J]. China Navigation, 2017, 040(004):99-103.
- [5] Lu Mei, Sun Yuqing. China's maritime education facing the era of autonomous ships[J]. Maritime Education Research, 2019, 036(002):1-6.