

Design and Application of AIS Technology in Marine Fishing Management

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Abstract: This paper summarily introduced the production safety problems during operation process of fishing ships in China. In order to solve these problems, we present the range and significance of utilizing AIS technology in the fishing ships management, and summarily introduced the scale of AIS technology construction in coastal region of China. What's more, this paper expounds construction scheme of AIS system, detailedly designs AIS terminal architecture, technical parameters, and the solution of AIS data transmission between fishing boats. We summarized the function of this system and specific problems during the managements of fishing ships, and present matters that need attention during the utilization of AIS technology. By building AIS system, we could reduce collision accidents, improve rate of successful rescue toward ships in distress, protect fisherman's lives and property security, all above have positive effects in promoting the construction of "safe fishing".

Key Word: AIS technology, marine fishery ship management, fishery safety production

I. INTRODUCTION

In recent years, along with rapid development of foreign trade and shipping industry, number of merchant ships increases sharp, contradiction about contending waters between waterway planning and traditional fishery grows, and the number of merchant ships in coastal fishery increases, raising the risk of collision. When the collision does happen, it always results in ships sinking, fisherman's injuries and deaths; What's more, because the ships are far offshore, climate and sea state are complex, the rescue work therefore is more difficult. In accidents caused by above reasons, major accidents accounts a high proportion, the number of one-time death (or missing) is also larger. [1]

AIS(Automatic Identification System) means marine automatic identification system, by using AIS marine station(wireless transponder) installed in cab, ships or administrative departments could know navigation information in time, includes static information such as ship

name, call sign, MMSI code, length, breadth, draught, ship type, and dynamic information like channel, speed, destination port etc.[2] As general safety electronic device in ships, AIS makes ships have function of being in sight of each other, dynamic positioning, and information transmission, and get little influence from environment and climate. AIS system can receive information from other ships and send its own information, in range of 20~30 sea miles, thus improve the identification rate. Therefore, utilizing AIS has significance in promoting the construction of anti-collision system, precaution of accidents, and ensuring property of fisherman.

II. DESIGN AND IMPLEMENTATION OF AIS SYSTEM

A. Overall architecture of AIS system

AIS consists of AIS terminal onboard, database center, AIS data link etc. System original data are from onboard terminal, which periodically sends, receives static, dynamic and shipping related information automatically, thus implements the communication among ships, between ship and shore. Maritime AIS offshore station system receives data, transmits maritime bureau AIS data to State fishery AIS management center by special network line, then these data are processed by server application. The overall architecture is show as below:

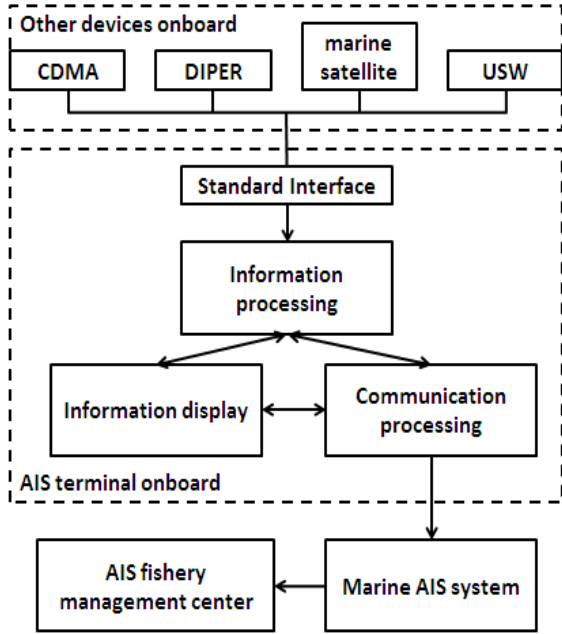


Figure 1. Fishery AIS system diagram

B. Basic constitution of AIS terminal

AIS terminal onboard consists of three core components: AIS information processing module, communication module and displaying module.

(1) The information processing module stores basic information, receives shipping information captured by sensors. It can encode and transfer up to date shipping information and essential static information to communicating processing module to transmit them, and transfer shipping data information to monitor to display. The AIS can also provide shipping related information for radar and other shipping devices.

(2) AIS communicating processing module, controlled by system information processor, sends and receives regulated modulated signal automatically under communicating protocol, width of the signal is 25 KHz or 12.5 KHz. The module can exchange information on two channels at the same time, or switch to local specialized channel automatically.

(3) AIS displaying module mainly display ship and working condition information, information of other navigation devices can be also displayed on AIS monitor.

Meanwhile, AIS terminal onboard should receive shipping information from GPS/DGPS/GNSS, sync world time, and should be equipped with standard interfaces which can support UTC, gyroscopic compass, log, VDR, ARPA, ECDIS navigation devices. [4] Key technological parameters are below:

TABLE I. AIS TERMINAL KEY TECHNOLOGICAL PARAMETERS

Items	Parameters
Frequency range	156.025MHz~162.025MHz
Default channel	CH2087、CH2088

TDMA synchronization	Strictly sync with UTC time
Data interface	Including at least one RS232 or RS422 interface, up to IEC61162 standard
Data updating frequency	1Hz
Reservable track	More than 20000
Reservable ship route	More than 500
Reservable gauge point	More than 4000
Settable waypoint	More than 5000

C. AIS data transmission

AIS system data transmission and exchange are mainly proceed among ships, between ship and shore. AIS onboard terminal devices send AIS dynamic and static information to ships around and offshore station continually when turned on, and receive AIS information from other ships meanwhile. Other AIS onboard terminals display the ship to the chart and update dynamic information of the ship, and can alarm automatically when two ships are too close or overlaps possibly appear, in case of collision. AIS base station transfers the received AIS information to database center through data link, eventually to the position monitoring software for displaying, thus administrative department can query the real time position and shipping track of ships.

III. THE EFFECTS AND PROBLEMS OF AIS TECHNOLOGY IN MARINE FISHING MANAGEMENT

AIS can help ship find targets which cannot be detected by radar during the sailing. For water search and rescue, AIS can help ships grasp static and dynamic information of itself. In maritime investigations, dynamic conditions of both sides are clear, accident liability is also easy to determined, because shipping data of both sides are automatically reserved in AIS system. Therefore, by equipping AIS system for ships, we could improve the ship identification rate and ability of collision avoidance, reduce collision accidents, improve rate of successful rescue toward ships in distress, thus, protecting the fisherman's lives and property security

The differences between AIS devices and other communicating devices are: the latter has independence, troubles of one ship could not influence other ships. But one AIS terminal is a component of the whole AIS system, each terminal can directly affect other terminals. [5] So we should pay attention to related problems when using AIS technology:

(1) AIS devices must be designed under ITU-RM.1371AIS technological standard, and assembled according chapter5 in SOLAS convention about AIS assembling requirement and approved decision in MSC73. If nonstandard AIS devices are found during system running, the system forces the timing transmission, even artificially increase the times of transmission, to "improve" monitoring effect, thus affects the whole system in functioning.

(2) Some AIS device manufactures have added alarm function to AIS, we always receive wrong information when the system is running, which affect AIS operation, some defective devices cause continuous alarms, affecting fisherman and administrative departments. To this problem, IMO has issued special circular, discouraging the addition of alarm button and the alarm function attached to AIS. So

devices which are not equipped with alarm function should be selected when we are constructing the AIS system for ships.

(3) For each onboard AIS system, there needs nine-character MMSI codes. Situations like two ships shares identical MMSI code caused by wrong input would lead that other ships cannot receive the correct position. Wrong basic data may be inputted to some devices, so we should check integrity and validity of the data inputted, ensuring the proper operation of AIS system.

(4) Since some of fishermen break the rule to close AIS device, AIS should record operating condition. This function is used to management and inspection. Moreover, it can be consultation in accident.

IV. CONCLUSION

Rational utilization of AIS technology and construction of AIS system can improve ability of anti-collision, self and mutual aid, and can improve dynamic monitoring ability, and reactivity ability, for fishery administrative department, thus collision accidents can be reduced effectively, rate of successful rescue toward ships in distress can be improved, fisherman's lives and property security can be ensured, all above have positive effects in promoting the construction of "safe fishing". Besides, AIS technology will have a more widely application prospects in fields like ship scheduling, fishing management, inward and outward the port management etc. In consideration of the problems occurs in the application process of AIS technology, we should continue the research work in both technology research and management, to provide technological support for modern fishery industry.

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Article related funding project:

Special fund project of "Special Scientific Research Funds for Central Non-profit Institutes, Chinese Academy of Fishery Sciences". (item number: 2014A10XK06)

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