

Framework and Technology of Integrated Ship-Shore Information System

ZHANG Ying-jun¹, DONG Fang², ZHANG Xiu-guo³, ZHU Fei-xiang¹

(1. Institute of Nautical Science & Technology, Dalian Maritime Univ., Dalian 116026, China;

2. Navigation College, Dalian Maritime Univ., Dalian 116026, China;

3. College of Computer Science & Technology, Dalian Maritime Univ., Dalian 116026, China)

Abstract Integrated Ship-Shore Information System makes use of advanced technology of marine mobile communication and extends the computer network of shipping company to ship. This system conveniently accomplishes the information exchange between company and ship, guarantees navigation safety and improves commercial performance. The framework of integrated ship-shore information system and the analysis of its function are provided in this paper. Meanwhile, the idea based on the specification of J2EE to build this system is put forward and the relevant technology is demonstrated.

Key words Ship-Shore Information System, Marine Mobile Communication, Ship LAN, J2EE

1 Introduction

Today, many countries in the world attach importance to the application of information technology in marine traffic area. It is well known that ship is the basic produce element of shipping company. Hence, it is more important to fluently communicate with land for a ship operating in complex surround, in particular dangerous marine environment. Integrated ship-shore information system utilizes advanced technology of marine mobile communication and computer network to extend network of company to ship, which makes the ship become a mobile terminal or mobile subnet. That is to say, the integration of the Ship Management Information System (SMIS) and the Company Management Information System (CMIS) is the underpinning of Integrated Ship-Shore Information System (ISSIS). Through this system, the information, such as the video or image of ship navigation status, is transferred from ship LAN to monitoring and controlling center on shore, so company realizes distant visual dynamic monitoring to ship. Furthermore, ship connects to database on shore and real time obtains a great deal of useful information, so the captain is able to get the optimization of navigation decision.

The establishment of ISSIS, undoubtedly, will bring improvement on company management, will strengthen monitoring from company to ship, will enhance navigational safety, will be useful to the maintenance of the ship and equipment, will cut down the cost of communication between ship and shore as well as improve the commercial performance of ship.

2 Framework and Function of ISSIS

This system emphasizes not only the share of information and the system integration, but also take into account the business relation and information interface between company and entities like Ship Classification Society (SCS) and Maritime Safety Authority (MSA). The following Figure 1 illustrates the framework of ISSIS.

On board, SMIS contains ship safety management system, engine maintenance and management system, ship dynamical monitoring and pre-alarming system, which connect to each other by ship LAN. Ship safety management system includes ship's basic parameter management, convention and regulation management, ship navigation management, ship moorage management, supervising status of ship loading, ship preventing pollution management, emergency response, ship safety inspecting, statistic and analysis maritime accident, ship reporting system, crew management, document-certificate management, communication management. Engine maintenance and management system consists of document management, spare parts management, store management, fuel and lube oil management, maintenance of the ship and equipment, dock repair, FSC (flag state control), PSC (port state control), statement report producing. Ship dynamical monitoring and pre-alarming system receives information provided by VDR (voyage data recorder) to develop enhanced function, to evaluate the navigation safety and achieve

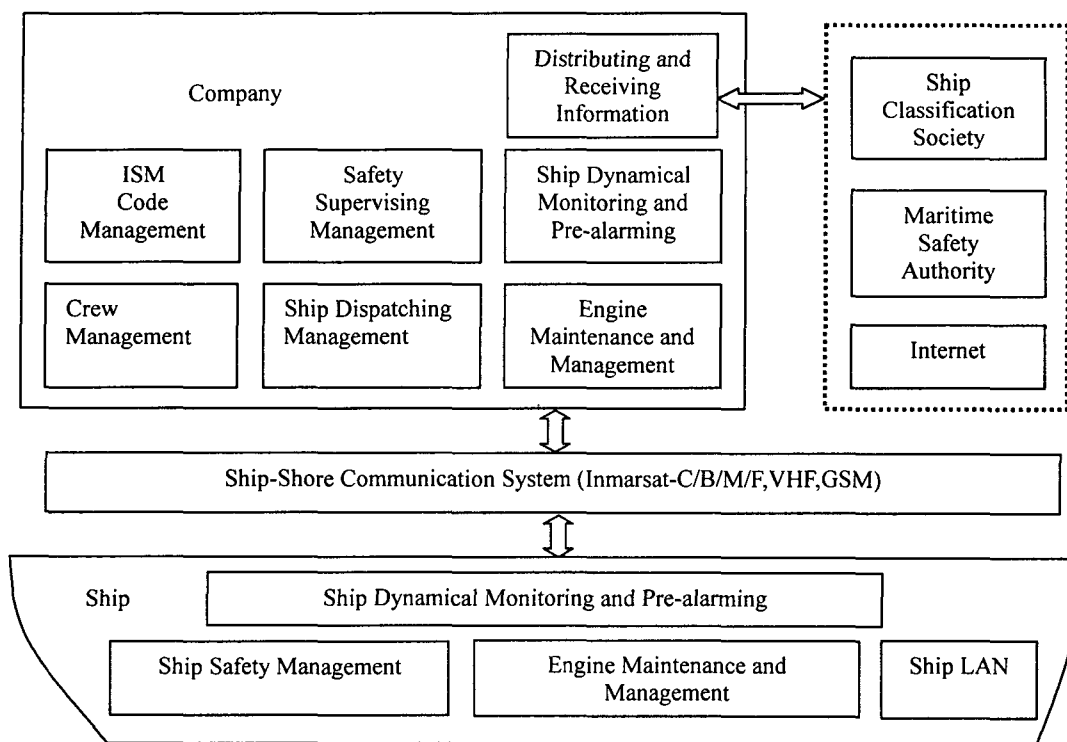


Figure 1 Framework of ISSIS

the pre-alarmed function.

Through ship-shore communication system, such as Inmarsat (International Maritime Satellite)-C/B/M/F, VHF and GSM, ship LAN connects to network of company on shore. And so that ship safety management system and engine maintenance and management system based on the integration of shore and ship come into being.

CMIS includes ship dispatching management system, crew management system, ISM (international management code for the safe operation of ship and for pollution prevention) code management system, safety supervising management system, engine maintenance and management system, ship dynamical monitoring and pre-alarmed system. The connection between ship LAN and company Intranet is designed to guarantee the share of information.

Through the ship-shore communication system, ship dispatching management system can indirectly manage navigating status, port operation, loading condition, maintenance, condition of accident, can give a voyage order to ship and work out the voyage budget.

Crew management system deals with something concerning personal management, crew allocation, audit of crew wage, renting fee, and gives a integrated evaluation of crew's performance. All information of ship crew management can be transferred to company crew management system.

ISM supplies nice management based on work flowing to constitute, verify and modify document of SMS (safety management system) of company. Shipping company adopts right SMS according to the general requirement of ISM. Modification and complementation of document of SMS, which are supplied by company can be transferred to ship in time, meanwhile, the record of SMS implementation also can be transferred to company from ship for inspection.

Engine maintenance and management system is based on the connection between ship LAN and LAN on shore and connects to the extern supplying system. It is useful to stocking spares to research the math model based on the statistics law, which estimates the use and lifespan of spares. Company queries the detail information of main unit by making the 3D perspective of every ship's structure.

According to the data from the navigation system and the power system, ship dynamical monitoring and pre-alarmed system on shore evaluates the safety and real-time controls the status of navigation, giving the alarm to ship when necessary. Obviously, transferring information provided by VDR to shore is an effective approach to accomplish the data collecting of navigation system and power system.

Safety supervising management on shore includes resource management, communication management, record management, emergency response, navigation monitoring, navigation security and statistic of accident.

Company communicates with MSA, SCS and Internet through the distributing and receiving information system. So, company gets the manifest of ship surveying and other relevant useful information that is also shared by ship LAN.

3 Technology of ISSIS

3.1 ship-shore communication network

The ship-shore communication network of ISSIS is illustrated by Figure 2. There are two modes of communication. First, ocean ship communicates with coast earth station through the Inmarsat-A/B/M/C/F, and coast earth station connects to company Intranet through VPN (Virtual Private Network). Second, ship alongshore communicates with company Intranet through shore-based wireless communication network (using data transferring channel VHF/GSM). Shipping company connects to extern entities (SCS, MSA, Internet) through VPN.

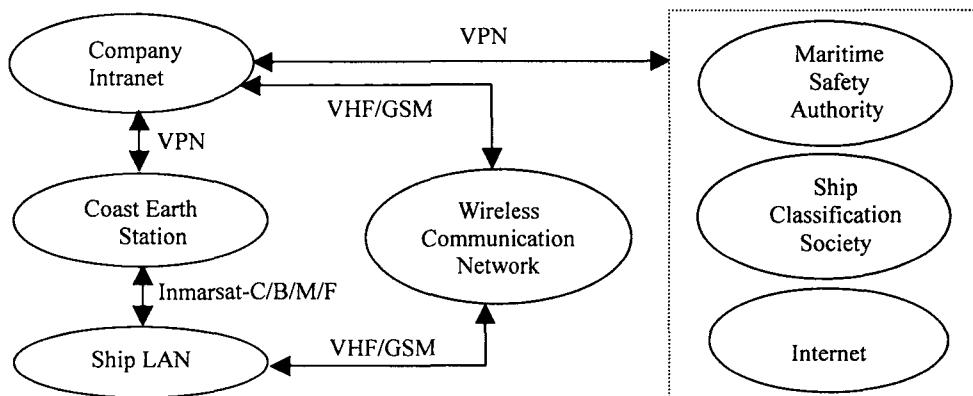


Figure 2 Ship-shore communication network of ISSIS

3.2 Adoption of J2EE specification

ISSIS based on the integration of SMIS and CMIS is a typical distributed system. Therefore, J2EE specification is appropriate to build this system.

The J2EE platform adopts a multitiered distributed application model and divides the application into client tier, web tier, business tier and database (enterprise information system) tier. Application program are divided into some components. These components are fixed in different computers, whose position is dependent upon their tiers in J2EE.

It is obvious that Multitiered distributed application model is not only suitable for SMIS, but also suitable for CMIS and ISSIS. In the whole system, J2EE server and database server which both lie in SMIS, CMIS are integrated and converted into logical J2EE server and database server. This is the essence of distributed system. Every client is collocated to visit all or portion of servers. Moreover, other information system in enterprise also can be integrated into ISSIS through applying J2EE specification.

3.3 General ship-shore communication software platform

Ship-shore communication system is information transferring channel of ISSIS. Different communicating modes in ISSIS, such as Inmarsat-A/B/C/M/F, VHF, GSM, require us to research

general software platform which automatically selects communicating mode and realizes the connection between ship LAN and network on shore, in accordance with navigation area, cost of communication, strength of signal. This platform is designed for layered structure. The lowest layer accesses to different communication equipments, while the highest layer is independent of the communication equipments. At present, with MPSD (mobile packet data service) of Inmarsat-F and TCP/IP protocol, ship can connect to Web site of company or ISP on shore.

3.4 Application of Electronic Chart

Electronic chart system based on individual computer has been widely applied to ship navigation and shipping company management. We should research electronic chart application server to realize the share of electronic navigational chart database, and we can show, query, process information in visual manner under integrated electronic chart platform based on Internet.

4 Conclusion

In this paper, the framework and function of ISSIS is applicable for shipping companies to develop the information system, and the technology of ISSIS is instructive for implementing this system.

The communication between ship and shore plays a important role in developing application of information technology in marine traffic area. Because of the high cost and the low speed of the communication, we should analysis the contents of communication and reduce the quantity of information. But, we believe, with the development of technology of wireless communication, a low-cost maritime communication system with wide band will guarantee the online connection between ship and shore and ISSIS will be implemented with great efficiency.

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