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Technical Domain / Task Number 2 …………………………………

Author(s) / Submitter(s) China Maritime Safety Administration

Introduction of Test Results and Technical Services Architecture on Yangtze Estuary e-Navigation Testbed

# summary

The Yangtze Estuary e-Navigation Testbed(hereinafter referred to as the "The Testbed"), targeting at the requirements of improving navigation efficiency of Yangtze Estuary deep water channel using natural side water depth, based on e-navigation Common Shore-based System Architecture, built the Maritime Connectivity Platform(MCP), designed and developed hydro meteorological service, routing service and Aids to Navigation(AtoN) service, etc., integrated the LTE broadband communication technology, Beidou short message communication technology and CORS high precision positioning technology, developed the shipborne integrated digital communication system. Ship to shore information exchange and display for ships users via ECDIS or ECS has been achieved, enabling effective management over ultra-wide vessels in the Yangtze estuary channel to improve navigation efficiency using natural side water depth.

# background

# The 12.5m deep water channel of Yangtze Estuary is an artificial channel, with a total length of 92.2km and a width of 350-400m. With rapid development of ship technologies, the increasing of ship traffic flow and size in this deep water channel constantly cause the issue of ultra-wide and safe rendezvous between large heavy-loaded container ships and large international cruise ships. In order to improve the navigation efficiency of Yangtze Estuary channel, it is necessary to use information technology to provide technical support to ensure navigation safety of ships.

# Against this background, China MSA launched the Yangtze Estuary E-Navigation Testbed, assisting ships to use the channel’s natural side water depth to rendezvous. Between 2016 and 2018, Donghai Navigation Safety Administration(DNSA) carried out this construction project with permission of China MSA.

# The Yangtze Estuary e-Navigation Project is based on the e-Navigation related guidelines of the International Navigational Standards Association (IALA), CSSA shore-based architecture and CMDS general data architecture. Through the interactive coordination of ship and shore information, the use of automatic collection, fusion, and analysis of ship positions, CCTV and routes, expected exchange points and other information from the ship end and the shore end, to provide auxiliary management analysis for shore-based maritime regulatory agencies. It also provides shipside users as required with navigation auxiliary decision-making information such as high-precision positioning, hydrology, meteorology, route exchange, and dynamic position of AtoNs, so as to effectively enhance shipside users' comprehensive situational awareness and eventually facilitate navigation safety and marine environment protection.

# System technical architecture and services

The Testbed was to improve navigation efficiency with ultra-wide vessels safe navigation and approach in the deep water channel using the natural side water depth of the channel. For this purpose, the Testbed has developed effective channel identification service, using virtual AIS AtoN and physical AtoN to mark channel boundary and side boundary, which was sent to the intelligent navigation terminals (ECS or ECDIS) of ships navigating in Yangtze Estuary channel through AIS or LTE communication links, enabling navigators to check the boundaries in real time.

The intelligent navigation terminals of ships can obtain high-precision position correction data of shore-based CORS system through LTE communication links to improve ship positioning accuracy. The navigators can obtain the ship's recommended route information and hydro-meteorological information through LTE communication links to ensure navigation safety.

The shore-based supervision center users can obtain real-time traffic status of ships on theAIS, LTE and Beidou short message links, send various service information on demand to various shore-based users registered and registered services on the Maritime Connectivity Platform (MCP) through MCP. Among them, the MCP carries the information between users and services, services and services, ships and services, ships and shore-based users, which is the information transmission pipeline and information transmission route execution body of the Testbed.

Based on the descriptionabove, the overall technical architecture of the Demonstration System is shown in Figure 1,including the following maritime service(MS):

● MS1: VTS Information service (INS)；

● MS 2: VTS Navigational assistance service (NAS) ；

● MS 3: Traffic organization service (TOS) ;

● MS 5: Maritime safety information (MSI) service;

● MS 8: Vessel shore reporting;

●MS 14: Meteorological information service.

The maritime services based on the following technical services:

● LTE communication technology service;

●Beidou short message communication technology service;

● CORS high precision technical service;

● AIS ;

● CCTV ;

●Hydro-meteorological information acquisition service,and

● Maritime connectivity platform technology services,etc.

As for the ship borne system, based on ECS and ECDIS, additional shipborne service functions have been achieved, including:

● Shipborne integrated Aids to Navigation service function;

● Shipborne integrated digital broadband communication technology service function.

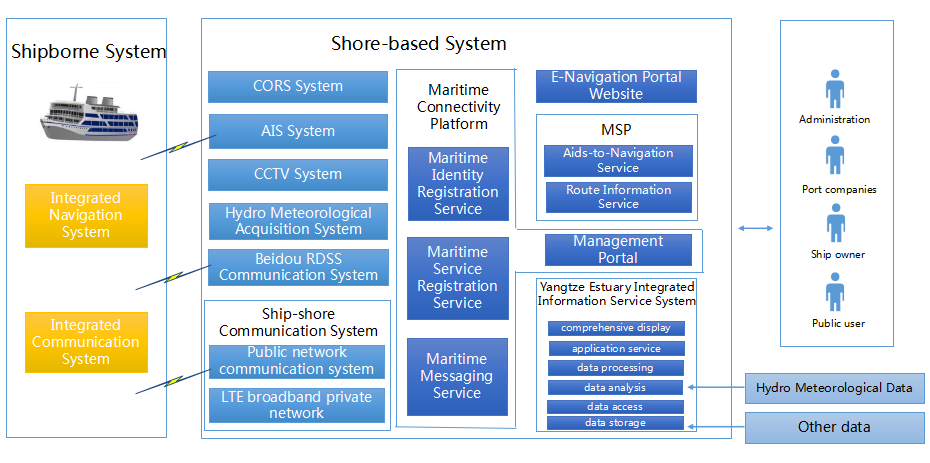


Figure 1. System architecture diagram

# Achievements of system construction

The construction of the Testbed was completed in August 2018 and has been entering the trial operation stage. On September 1, 2018, on-board system test was conducted in the Yangtze Estuary deep water channel, with COSCO Americas approaching other ultra-wide ships.

.1 Ships can make use of the maritime services provided by the system (MS1-3, MS5, MS8, MS14) to approach and avoid collision with other ships in the deep water channel using the natural side water depth;

.2 The constructed technical service systems have been operating normally which could support the maritime data and information requirements for the normal operation of the above-mentioned various maritime services;

.3 The ship borne intelligent navigation terminal based on ECS or ECDIS system has been operating normally which could realize the information exchange and display between ship and shore;

.4 The Maritime Connectivity Platform has been running steadily, which could support the automatic and manual registration of ships, the registration of various maritime services and technical services, enabling various users of the Testbed to obtain information and data on demand.

# Reference

See related documents.

# Action requested

The ENAV committee is kindly requested to review the information of this paper and provide comments. Additionally, put appendix 1 information on the IALA website “E-NAVIGATION TESTBEDS AND FAQ” at the discretion of the committee.

**APPENDIX 1**

1. Submitting Organization: Yangtze Estuary e-Navigation Testbed

2. Point-of-Contact

●Name: Xuyao Zhou

●e-mail address: zhouxuyao1966@126.com

3. Brief Description

The Yangtze Estuary e-Navigation Testbed(hereinafter referred to as the "The Testbed"), targeting at the demand of improving navigation efficiency of Yangtze Estuary deep water channel using natural depth of slope, based on e-navigation Common Shore-based System Architecture, built the Maritime Connectivity Platform(MCP), designed and developed hydro meteorological service,routing service and Aids to Navigation(AtoN) service,etc., have integrated the LTE broadband communication technology, Beidou short message communication technology and CORS high precision positioning technology, developed the ship borne integrated digital communication system. Ship to shore information exchange and display of ships users by ECDIS or ECS has been achieved.

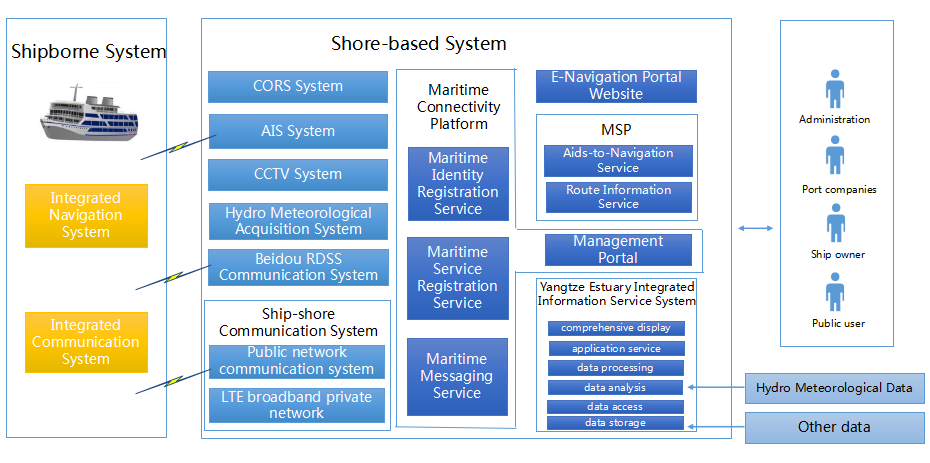


Figure 1. Overall Architecture of Yangtze Estuary e-Navigation Testbed

●Display type (such as RADAR, ECDIS, ECS or Head-up display)

ECDIS&ECS.

1. Functional Capabilities

The Testbed provides the following maritime service(MS):

● MS1: VTS Information service (INS)；

● MS 2: VTS Navigational assistance service (NAS) ；

● MS 3: Traffic organization service (TOS) ;

● MS 5: Maritime safety information (MSI) service;

● MS 8: Vessel shore reporting;

● MS 14: Meteorological information service.

The MS above relying on the following technical services provides services for related shipside users:

● Marine LTE broadband communication technology service;

●Beidou short message communication technology service;

● CORS high precision technical service;

● AIS technology service;

● CCTV video technology service;

● Hydro meteorological information acquisition service,and

● Maritime connectivity platform technology services,etc.

Moreover, based on ECS and ECDIS, additional ship borne service functions have been achieved, including:

● Ship borne integrated Aids to Navigation service function;

● Ship borne integrated digital broadband communication technology service function.

1. Intended Objectives

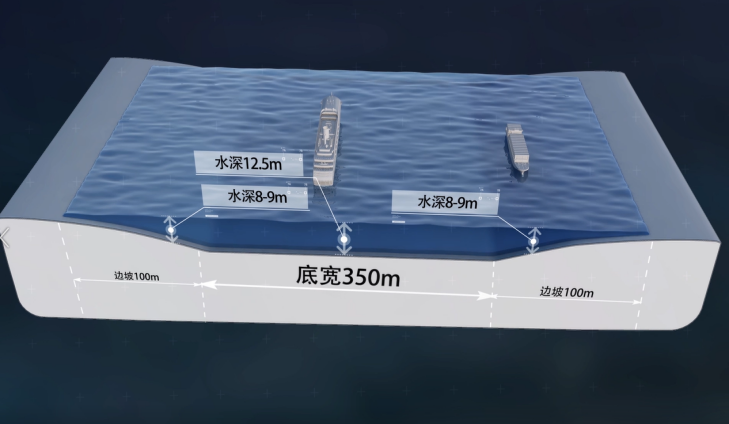
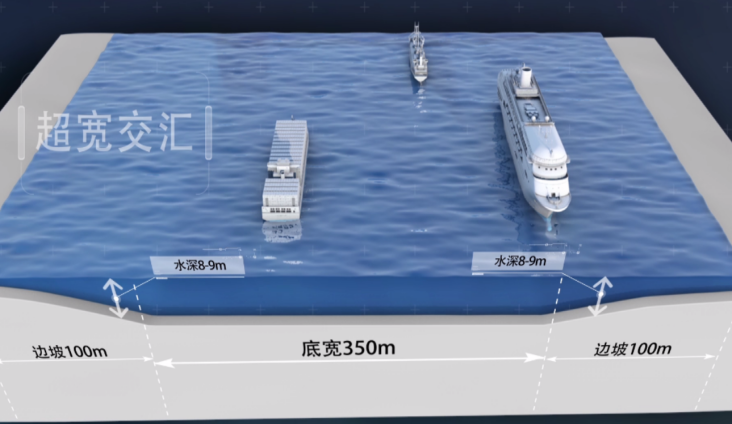
● Serving vessels navigating in Yangtze Estuary using the slope channel with improved navigation efficiency and enhanced navigation safety;

● Contributing to the implementation of IMO e-Navigation strategy;

● Facilitating in formulating technical specifications of MCP;

● Promoting application of new technologies in maritime service;

1. Portrayal examples



1. Last edited (date)

October 1, 2020.

1. [↑](#footnote-ref-1)
2. [↑](#footnote-ref-2)