Input paper: [[1]](#footnote-2) ENAV26-5.1.10.3

Input paper for the following Committee(s): check as appropriate Purpose of paper:

**□** ARM **□** ENG **□** PAP **□** Input

**X** ENAV **□** VTS **X** Information

Agenda item [[2]](#footnote-3) 5.1.10

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

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Report on e-Navigation Implementation in South China Sea

# Summary

The China Maritime Safety Administration (MSA) has developed the South China Sea (SCS) e-Navigation Shore-based System. It has developed a series of e-navigation services which have covered the coastal waters of the South China Sea and the inland waters of the Pearl River.

It has developed a series of e-Navigation Technical Service Specifications, on which the service instances are developed. These services have been applied to vessels navigating in the coastal waters of the South China Sea, especially in some important waters, such as the Guangdong-Hong Kong-Macao Greater Bay Area, Qiongzhou Strait, Pearl River System, Beibu Gulf, etc. These services are capable of providing support for ship navigation and decision-making.

Table 1 is the application statistics from September 2019 to August 2020.

1. Application statistics from September 2019 to August 2020

|  |  |
| --- | --- |
| **Content** | **Statistic** |
| Users registered | 14.2K |
| Monthly active users | 10.5K |
| Concurrent users | about 200 |
| Vessels registered | 12k |
| Total online time of users | 68 Years |
| The number of e-Navigation technical services access | 150M times |
| The number of push messages | 10M times |
| The number of routes service requested | 390k times |

# Background

The development of e-Navigation shore-based System in South China Sea started in 2016. The initial project is the Pearl River Delta E-Navigation Testbed. The development of the system architecture was completed in 2017. The first series of e-Navigation technical services were available in March 2018. The development of the second project started in May 2018 and was completed in December 2019. The system architecture had been upgraded, as well as the technical services. A new series of technical services were available in the second project, and the service coverage was extended to the coastal waters of the South China Sea.

The SCS e-Navigation Shore-based System adopts a service-oriented architecture (SOA) and complies with IALA CSSA architecture. The Technical Service specifications were developed in accordance with IALA Guideline 1128 - The Specification Of E-Navigation Technical Services, Edition 1.1, and corresponding service instances have been developed on this basis. E-Navigation services are provided to mariners and authorities through suitable communication methods and client applications, such as ECDIS or web-based applications.

# design

According to the IMO Initial Descriptions of Maritime Services In The Context Of e-Navigation, MSC.1/Circ.1610, the system implements parts of the following six Digital Maritime Services (MS):

* MS 1 - VTS Information Service (INS): services for ship navigation situation awareness based on AIS data, for example, position, identity, destination of vessels and the intention of other traffic;
* MS 2 - Navigation Assistance Service (NAS): services to assist onboard navigational decision-making and to monitor its effects, for example, gives warning to the vessel about dangerous or not in compliance with regulations, provides a safe and efficient route to berth, etc.;
* MS 3 - Traffic Organization Service (TOS): services to support Traffic organization service (TOS), for example, provides information about assignment of an anchorage position, lock passage planning to vessels;
* MS 5 - Marine Safety Information Service (MSI): services to provide information related to navigational and meteorological warnings, meteorological forecasts and other urgent safety-related messages. The data model of navigational warnings refers to IHO S-124, draft v2.0.0.
* MS 14 - Meteorological Information Service, and MS 15 - Real-time Hydrological and Environmental Information Service: to provide hydrological and meteorological information digitally to ships. The data comes from coastal hydrological stations and buoys, and warnings and forecasts of weather from meteorological authorities.

# Key technologies

## E-Navigation Shore-based System

The shore-based system integrated various information related to navigation, such as marine geographic information, route information, tide information, AIS, traffic regulations, navigation warnings, port operations arrangements，these data were modeled according to the CDMS, that is IHO S-100 standard, and the technical service specifications were developed refer to IALA Guideline 1128, and then service instances were developed.

## E-Navigation Technical Specifications

In accordance with the IALA G1128 guidelines, eleven e-navigation technical services specifications have been developed, and 91 operation interfaces are provided.

1. Technical Specifications

|  |  |  |  |
| --- | --- | --- | --- |
| **Maritime Service** | **Technical Service** | **Description** | **operations** |
| MS 1 - VTS Information service（INS） | Ship information service | The service provides information about position, identity, destination of vessels. | 15 |
| Traffic management service | The service monitors traffic conditions and sends information or warning messages about the traffic situation to related systems. | 5 |
| MS 2 - VTS Navigational assistance service（NAS） | Route information service | This service supports recommending routes to vessels and exchanging planned routes between vessels | 13 |
| Navigational assistance service | The service to assist onboard navigation operations, such as gives warning to the vessel about dangerous or not in compliance with regulations. | 4 |
| MS 3 - Traffic organization service（TOS） | Harbour scheduling information service | The service provides information about harbour plan and schedule to vessels. | 7 |
| Lock passage planning information service | The service provides information about lock plan to vessels. | 12 |
| Warning of collision with fixed object | The service sends warning messages about collisions with fixed objects, such as bridges, offshore wind farm, to vessels. | 5 |
| MS 5 - Maritime Safety Information (MSI) service | NW service | Transmit the NW data encoded with S-124 to the shipboard system for graphical display. | 12 |
| Dynamic water depth warning service | Send warning of possible shallow water, which from reports or detected by crowdsourced sounding systems. | 1 |
| MS 14 - Meteorological Information service  MS 15 - Real-time hydrological and environmental information services | Hydrological and meteorological Information service | To provide hydrological and meteorological information digitally to ships | 13 |
| Urgent weather information service | Urgent and important weather information and warning. | 4 |
| **Total** | **11** |  | **91** |

## User Applications

Based on the e-Navigation Technical Services provided by the e-Navigation Shore-based System, different applications have been developed to meet different user needs. Table 3 shows the detail of user applications.

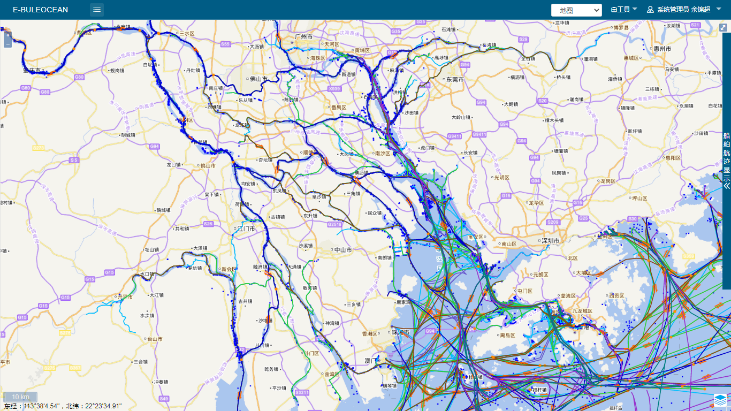
1. User Applications

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Applications** | **Description** | **Users** | | | |
| **Onboard** | **Shipowner** | **Authorities** | **others** |
| ECDIS | ECDIS could access Technical Services through appropriate communication means to support navigation. | X |  |  |  |
| Web-based applications | Access to technical services, through web services, such as SOAP, REST, could monitor ship traffic and exchange information with the ship’s systems. |  | X | X | X |
| Mobile Application | Access to Technical Services, through mobile communication, navigation information can be displayed and used, so as to assist navigation, and can exchange information with ECDIS. When mobile communication is not available, the application can connect to the shipboard navigation equipments via WIFI/Bluetooth to import navigation data. | X | X |  | X |
| WeChat | WeChat is a Chinese multi-purpose messaging, social media and mobile payment app. It has been described as China's "app for everything" and a "super app" because of its wide range of functions.  Users can use services in the “e-Navigation” Service Account and Mini Program in WeChat, and the information is synchronized and interconnected with other applications, i.e. ECDIS, web applications and mobile apps.  In particular, you can receive instant messages about important navigation information of the ship you care about. | X | X | X | X |

# implementation

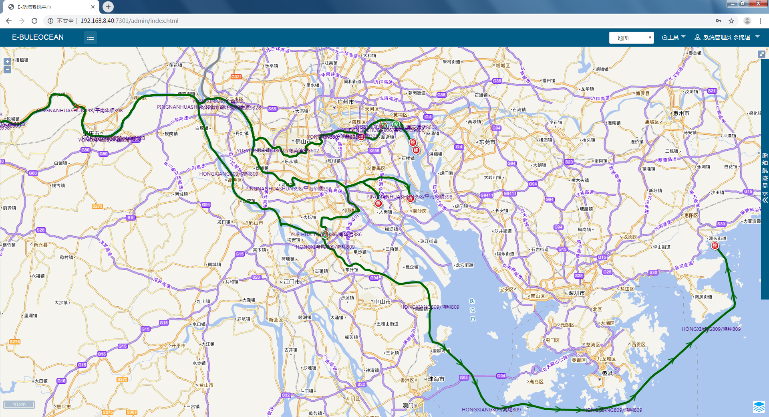
## Route Information Service

Analysed the historical routes of vessels from AIS, a route network is built up, which covers the coastal waters of the South China Sea and the inland waters of the Pearl River.



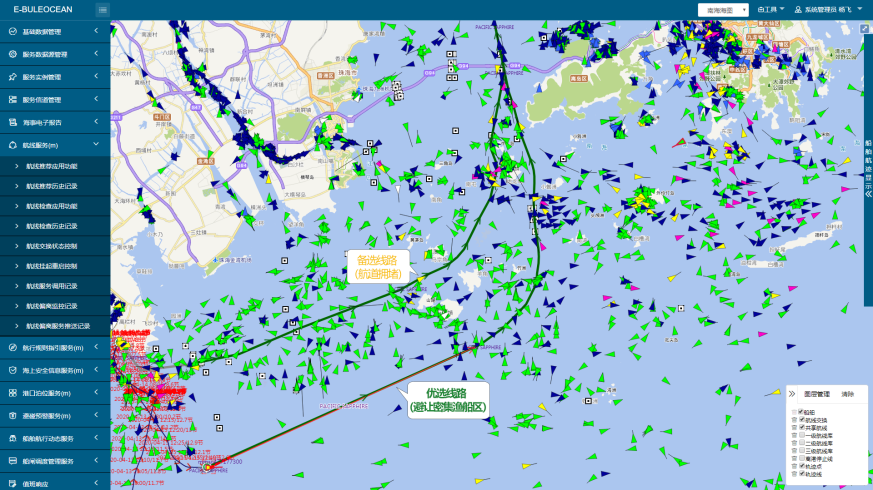
1. Route network of Guangdong-Hong Kong-Macao Greater Bay Area

Input parameters in the shipboard system, such as departure location, destination, draft, etc., based on the route network and combined with the spatial analysis of the ENCs, a safe and efficient route will be calculated and sent to the ship for planning route.



1. Examples of recommended routes for practical use on vessels

Considering factors such as hydrology and meteorology, ship congestion, etc., it can provide vessels with safe routes to avoid congested waterways or potential weather hazards.



1. Recommended routes to avoid congested waters

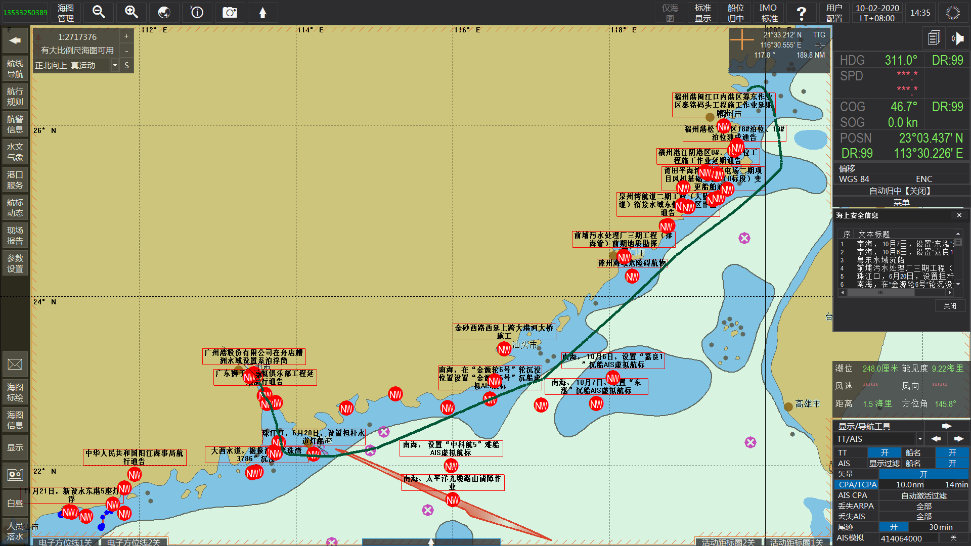
Route exchanges can be implemented through appropriate communication means, including mobile public communication, VDES, etc. When navigating in complex waters, through route exchange, mariners can check the planned routes of other nearby ships to understand their intentions, which can effectively reduce the risk of collision avoidance. The route exchange can be performed by the shore-based system when the mobile public communication is available, or it can also be exchanged directly between the vessels through the VDES. In the shore-based systems and web-based applications, the planned routes of all vessels could be seen, and the mariners can view the planned routes of nearby vessels in the onboard system.



1. Route exchange

## Maritime Safety Information Service

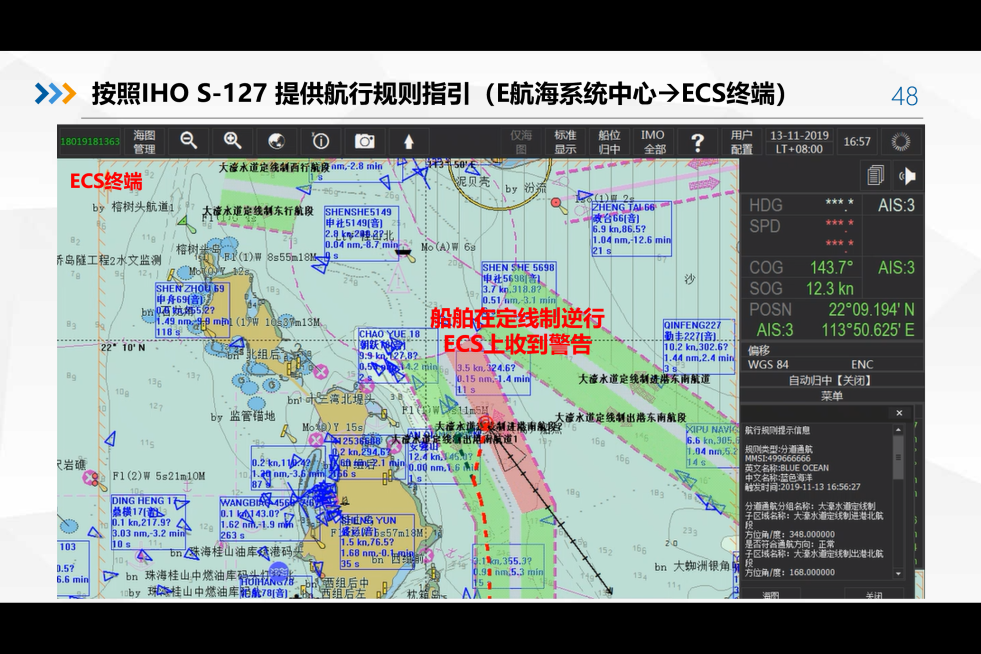
In the shore-based system, navigational warning data is modeled and maintained in accordance with IHO S-124 specifications. The MSI Technical Services are sent to shipboard system and related applications via the Internet and VDES, and will be display graphically. The shipboard system can filter and display the MSI related to the current voyage according to the planned route.



1. Display MSI according to the planned route

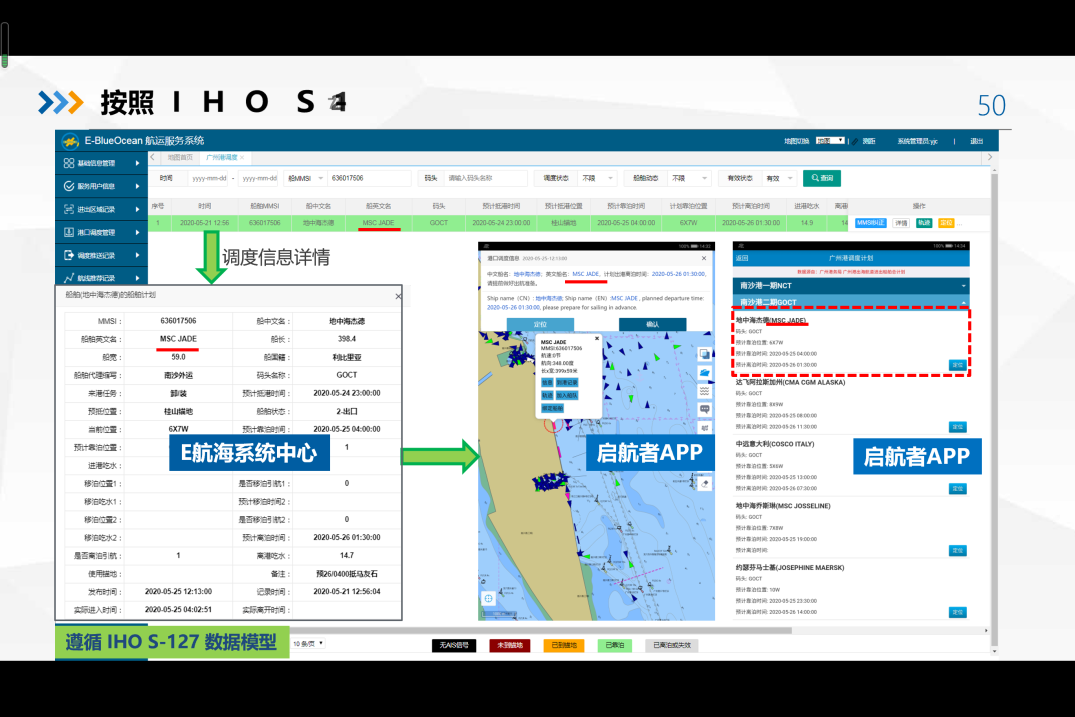
## Navigational Assistance Service

Traffic management information, i.e. recommendations, regulations, restrictions, and nautical information, is modeled and maintained in accordance with IHO S-127 specifications, and related e-Navigation Technical Services have been developed. During the ship's voyage, according to the ship's current position, speed, direction, and planned route, relevant instant navigation assistance messages an warnings will be pushed to the shipboard system.



1. Warning messages about failure to comply with traffic separation schemes

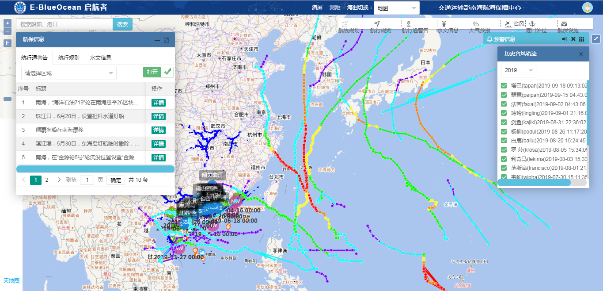
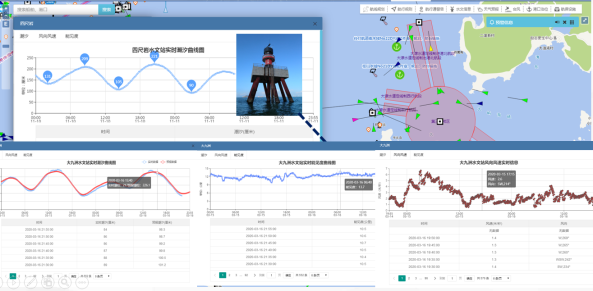
The harbour plan and schedule can be viewed in shipboard system and related applications, and the voyage can be arranged according to the harbour plan and schedule.



1. Harbour plan and schedule

## Hydrological and Meteorological Information Service

Modeling water level data in accordance with the IHO Water Level Information for Surface Navigation Product Specification (S-104), and surface current data in accordance with the IHO Surface Current Product Specification (S-111), and Technical Services were developed based on the above specifications. These data include real-time and forecast water level, current, wind, visibility, etc.. The real-time data is collected by coastal hydrometeorological observation stations and offshore buoys, and weather forecasts and warnings are from meteorological authorities. Similarly, through Technical Services, these data can be displayed and used in the related systems and applications.



1. Hydrological and meteorological information service

## Traffic management service

The service monitors traffic situation and sends information or warning messages about the traffic situation to related systems. Vessel's real-time locations mainly comes from AIS and VTS. Based on the real-time positioning data of the vessels, the situation of the vessels' traffic, such as entering and leaving a port, entering and leaving a specific area, can be identified. Some potentially risky navigation of the vessels can also be identified, for example, navigation in restricted waters, speeding, not navigating in accordance with the required time, risk of collision, etc.. For the above-identified situation, logs will be automatically recorded in the shore-based system, and information or warnings will be simultaneously pushed to various application systems through the e-Navigation Technical Services.

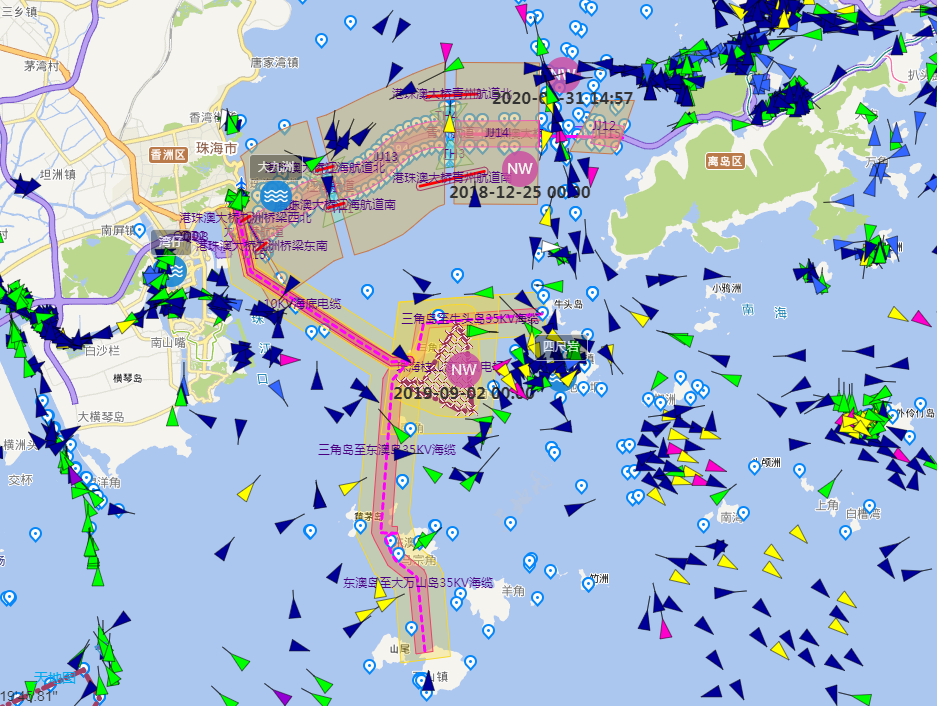




1. Traffic management logs

## Warning of Collision with Fixed Object

The purpose of this service is to prevent collisions with fixed objects on the water or shore, such as bridges, wind farms, etc., due to ship operation errors. It integrates AIS, VTS, hydrological and meteorological data, as well as the installed radar, laser, CCTV, infrared imaging, clearance monitoring equipment data, combined with the setting of the navigation restriction area, the potential risk of the ship colliding with fixed objects is analyzed. When it is discovered that a vessel possibly have a potential risk of colliding with a fixed object, the corresponding warning will be sent to the shipboard system and the relevant shore-based supervision system.



1. Collision prevention settings for Hong Kong-Zhuhai-Macao Bridge and Guishan Wind Farm

# Operation and Maintenance

A professional team was set up to maintain the shore-based system to ensure the stability of the system and to keep the service data up to date.

An E-Navigation user service department has been established to be responsible for the operation and maintenance of the e-navigation shore-based system and user services, providing online services for users 7×24 hours.

Web site: https://www.e-blueocean.com/

Mobile Applications for Android：<https://a.app.qq.com/dom/micro/open.jsp?pkgname=com.maphao.shipnavigation.show>

WeChat public service account: e-navigation

1. The QR code of the app and WeChat official account

Currently only the Chinese version is available. It is recommended to use network translation software.

# References

1. G1128 - The Specification Of E-Navigation Technical Services, Edition 1.1

# Action requested of the Committee

The committee is invited to note the above information.

1. Input document number, to be assigned by the Committee Secretary [↑](#footnote-ref-2)
2. Leave open if uncertain [↑](#footnote-ref-3)