Input paper: ARM16-6.2.2

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

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

**□** ENAV **□** VTS ☑ Information

Agenda item 6.2

Technical Domain / Task Number

Author(s) / Submitter(s) CHINA MSA

Experience Sharing on the AtoNs Adjustment for Ship Routing System of Qiongzhou Strait

1. **Background**

The ship routing system of Qiongzhou Strait was officially implemented in 2007 which aims especially at the most optimization and the most coordination of all correlative factors. However, along with the advancement of Hainan Free Trade Port, the rational distribution of port area is accelerating the adjustment. Some port functions are gradually moving west. In addition, a large ro-ro passenger wharf has been built. For the above reasons, the Qiongzhou Strait vessel traffic flow has changed greatly than before, and the original ship routing system is difficult to adapt to the current traffic flow situation. CHINA MSAalso has shared this information with all members on 75th IALA council, in order to adapt to the great changes of vessel traffic flow after the adjustment of the function of the port area and ensure the safety of ship navigation. CHINA MSAhas decided to improve the Qiongzhou strait ship routing system and adjust the aids to navigation, which involves 11 separation zones and 4 precautionary areas. After the readjustment of aids to navigation set up a total of 28 lighted buoys and 6 AIS physical AtoNs. This project involves a wide range, and there are many considerations and complex factors to be attention. CHINA MSAis willing to share the important basis and experience on the improvement of traffic separation with IALA members and provide a good project case for building a fully functional maritime ship routing system.

1. **Discussion**

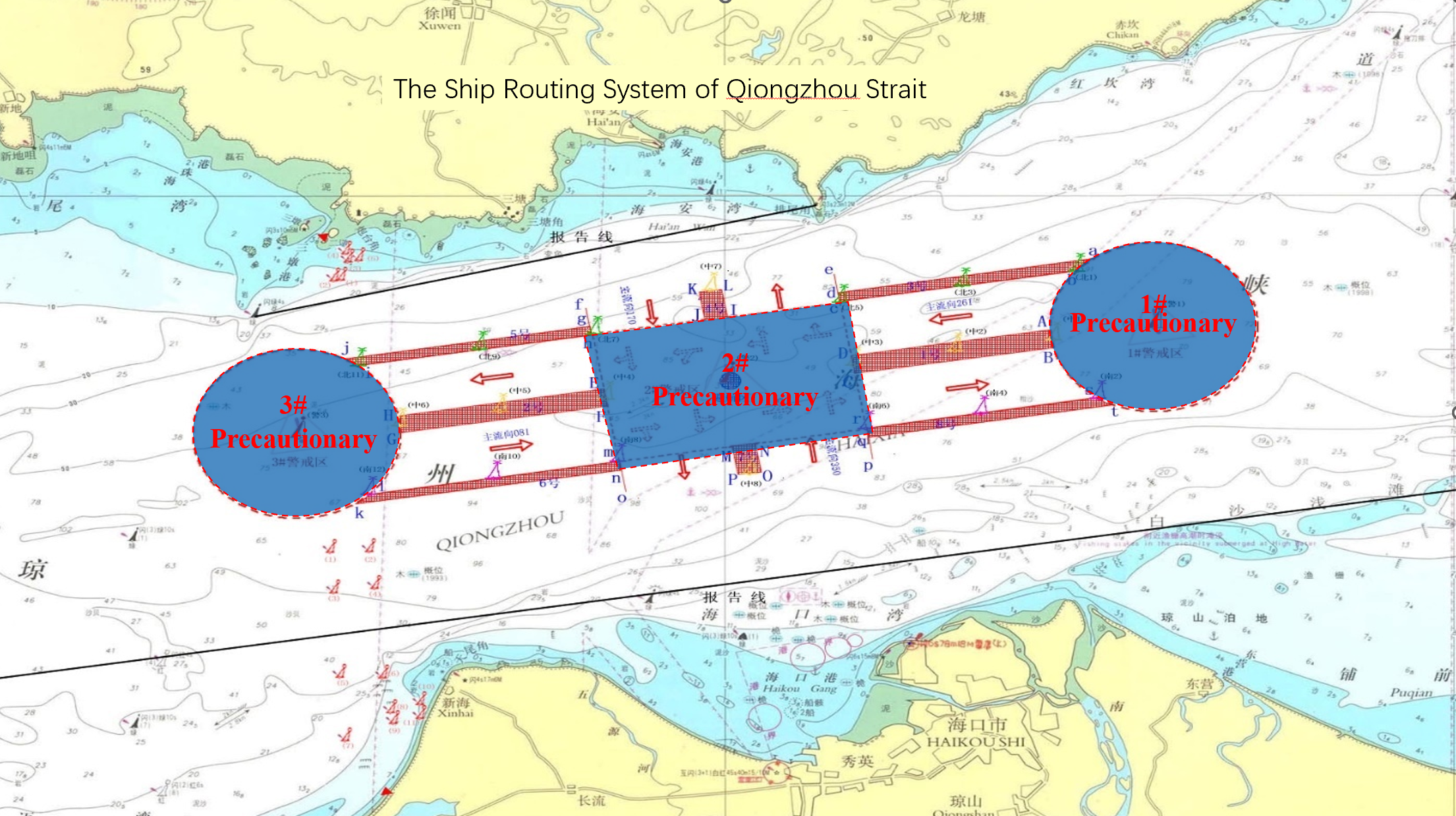
## 2.1 overview of Qiongzhou Strait

The Qiongzhou Strait is located between Leizhou Peninsula and Hainan Island, which is one of the three major straits in China. The strait is about 10-20 nautical miles wide, 10 nautical miles at its narrowest place, and about 50-60 nautical miles long, with an average depth of 44 meters and a maximum depth of 114 meters. It is a key water area for maritime traffic in China in which about 140,000 international and domestic ships are shuttled through the strait every year with large ship density, complex traffic flow and high safety risks.

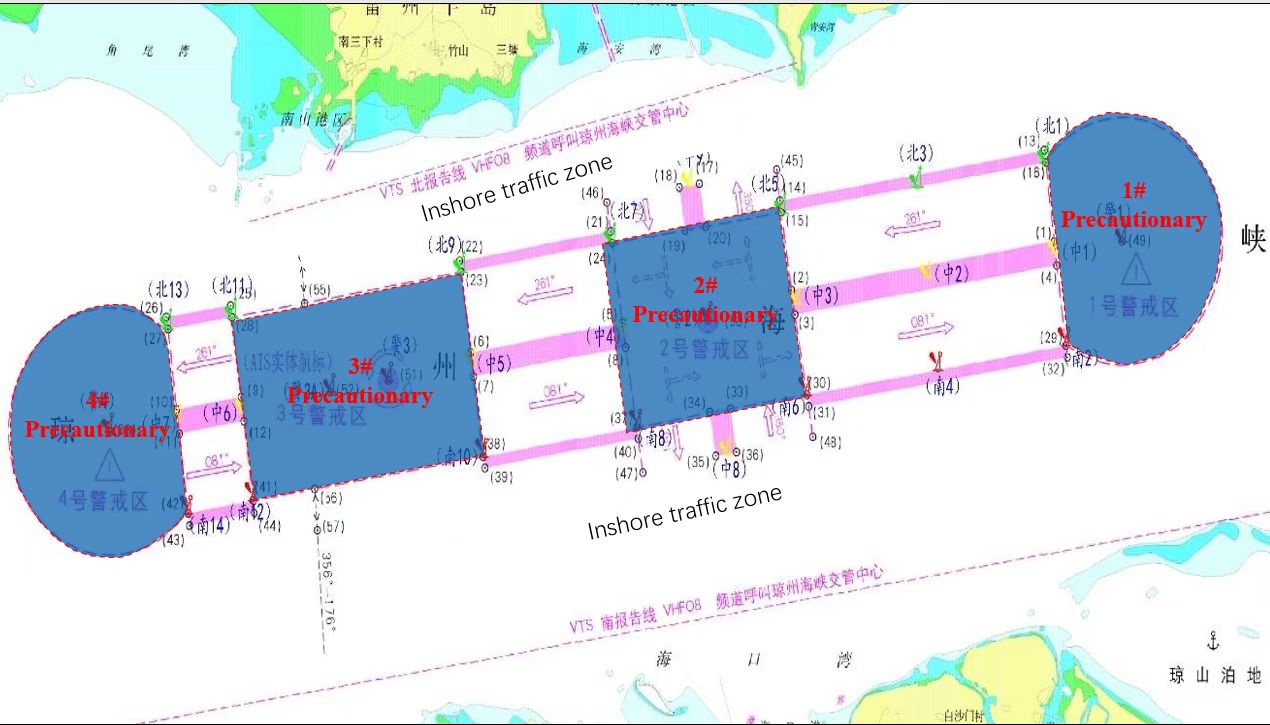
## 2.2 Ship routing system and AtoNs adjustment situation

### **2.2.1 Ship routing system after adjustment**

The improved ship routing system of Qiongzhou Strait consists of 11 traffic separation zones, 4 precautionary areas, 2 areas to be avoided, recommended traffic flow directions, recommended routes and inshore traffic zones. Compared with the earlier system, the new one system mainly expanded the No. 3 precautionary area, shortened the No.2 precautionary area, and added NO.4 precautionary area and 3 traffic separation zones that reduce the ship encountered situation and improve the efficiency of south-north ships passing through. In the meantime, the traffic lane was extended by 3 nautical miles to the west, with the total length increasing from 21 nautical miles to 24 nautical miles, improving the efficiency of east-west navigation.



*Figure 1. Qiongzhou Strait ship routing system diagram before adjustment*



**4#**

*Figure 2. Qiongzhou Strait ship routing system diagram*

**2.2.2 The placement of aids to navigation**

According to the improvement of Qiongzhou Strait ship routing system, the adjustment range of AtoNs layout relates to 11 separation zones and 4 precautionary areas in the above-mentioned areas with a total of 28 lighted buoys and 6 AIS physical AtoNs, and 2 virtual AIS AtoNs are removed. The adjusted ship routing system meets the relevant requirements of ***IALA R1001 THE IALA MARITIME BUOYAGE SYSTEM,*** and the main adjustments are as follows:

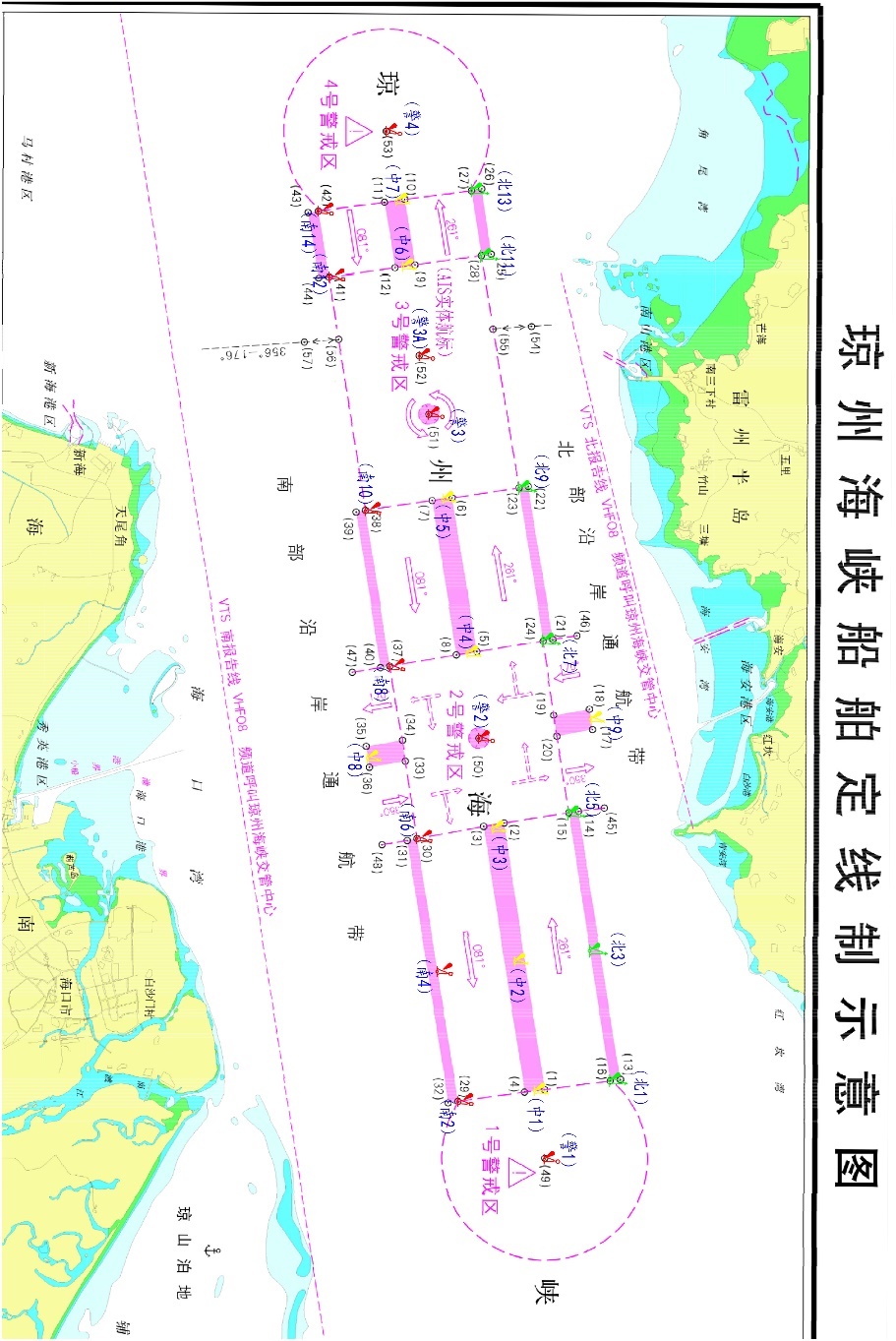
(1) The direction of traffic separation scheme is clockwise sailing around the mainland; The starboard hand marks are used to mark the north boundary line of the channel, and the port hand marks are used to mark the south boundary line of the channel, which is set in a symmetrical way. No.1, 2, 3, 5, 9 separation zones set special marks (TTS), and in 4 precautionary areas set the safety water mark.

(2) The length of the three separation zones (No.1, No.4 and No.8) which are adjacent to the No.1 precautionary area, is about 5.2 nautical miles, and in this area set up three lighted buoys in an equidistant way. The length of No. 5 and No. 9 zones are less than 1 nautical mile with one lighted buoy was set for each zone. Other separation zones are between 1 and 4 nautical miles in distance with one lighted buoy at each end. One lighted buoy was set in precautionary area No.1, 2 and 4 respectively. Set 2 light buoys in precautionary area 3. It is important to note that JING3# light floating around 0.2 nautical miles for the avoidance zone, and as the center of the circular road; JING3A# is used to separate the traffic between the Yuehai Railway ferry and the rolling passenger boats; The AIS terminal is installed on the JING3A# buoy, and the AIS issues a signal to the Yuehai Railway ferry ships, that is, when sailing to the No. 3 warning area, they should pass on the west side of the JING3A#.

(3) The characteristic of the starboard hand marks light is single flashing green for 4 seconds, and the characteristic of the port hand marks light is single flashing red for 4 seconds, with a range of 4 nautical miles. The lateral marks are numbered in the way of “double left and single right “along the channel. The characteristics of special marks (TTS) light is Mo (K) yellow 12 seconds with range of 4 nautical miles, along the waterway, take the “East - west first and north – south second” numbering. The characteristics of safety water marks are white for 10 seconds, with a range of 4 nautical miles, except for JING3A#, which uses Iso 4 seconds’ characteristics. Numbers are numbered along the direction of the channel.

(4) AIS terminals are set at the dense and important positions of traffic flow which a total of 6 AIS physical terminals are set on the JING1#, 2#, 3#, 3A# and 4 lighted buoys and the No. 8 and 9 lighted buoys.

(5) According to the water depth situation of the buoy location, the diameter of the anchor chain is 38mm, the length is about 3 and 7 shackles , and the weight of the sunken stone is about 5 and 7 tons.

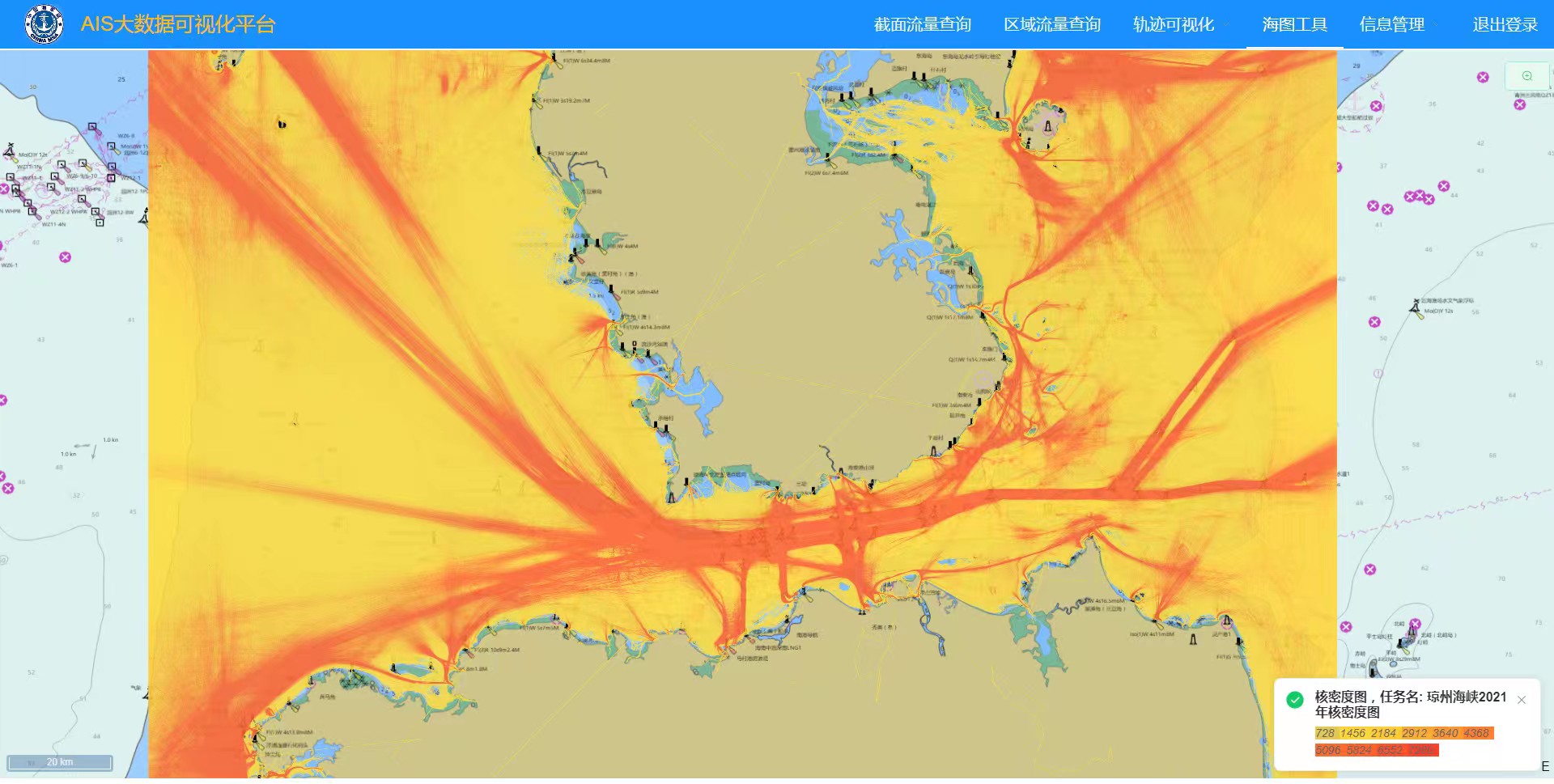


*Figure3. Diagram of AtoNs distributions in Qiongzhou Strait before adjustment*

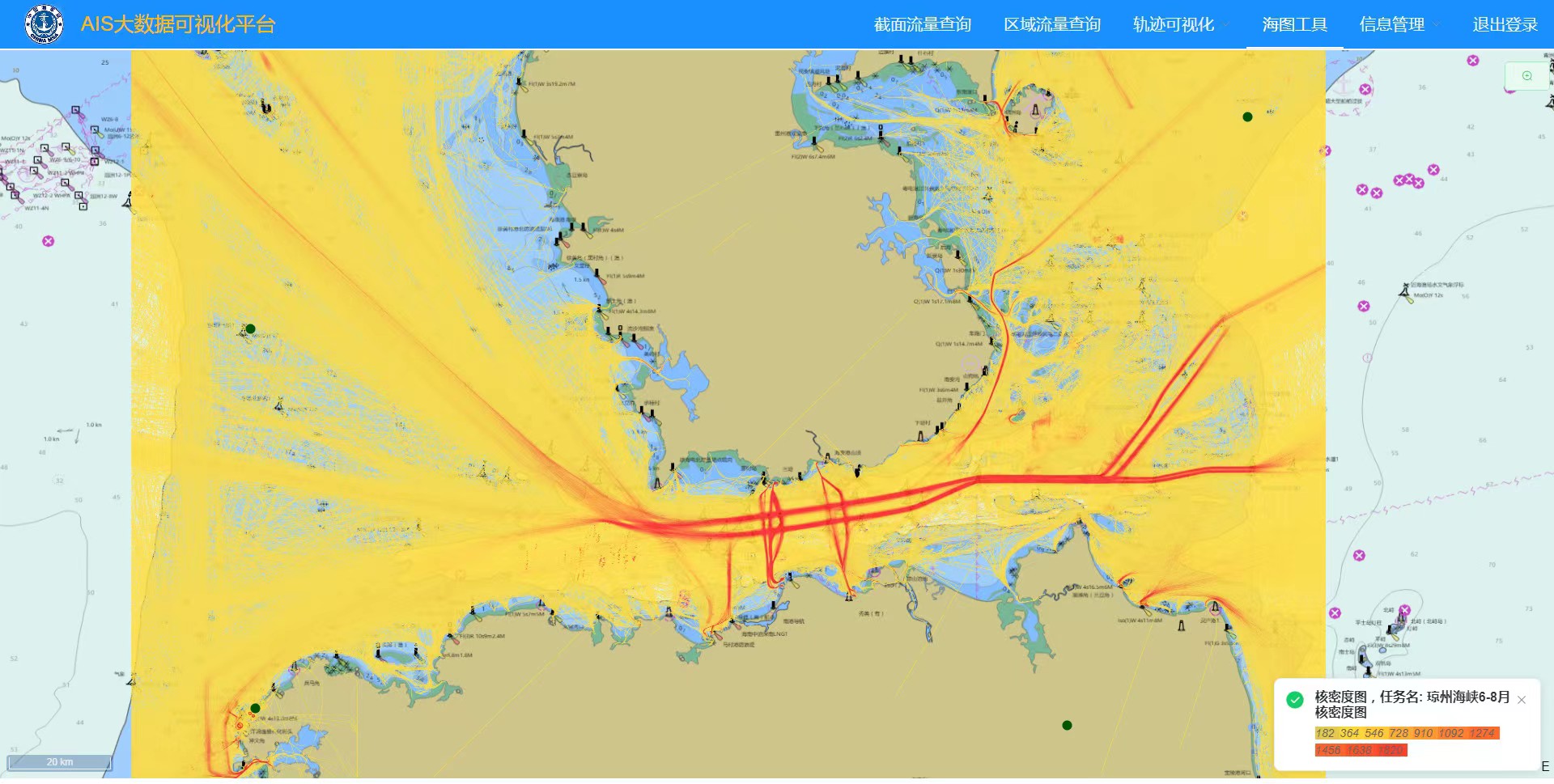
**2.3** [**experience**](javascript:;)

**2.3.1 Application of ships traffic flow statistics analysis results**

The ship routing system of Qiongzhou strait and AtoNs layout adjustment with fully application of AIS data for traffic flow statistical analysis, according to the traffic flow and risk degree of navigable waters could fully consider the natural conditions of the related water area and placement of aids to navigation. It is combined with the current situation of the westward shift of the functions of the existing port area which could provide the scientific basis for the adjustment projects.



*Figure 4. Traffic flow in Qiongzhou Strait before adjustment*



*Figure 4. Traffic flow in Qiongzhou Strait after adjustment*

**2.3.2 Application of risk management**

In this project, there are many complex risk factors that need to be considered and evaluated. It is necessary to comprehensively combine with the condition of hydrology, meteorology, engineering geology, traffic flow direction, submarine cable distribution, port function, and needs to form a closed loop. During the implementation of the adjustment of AtoNs, the implementing departments shall keep in close contact with related department which the duty for navigation safety, before making adjustment must issue the navigation warnings to the navigator in order to avoid collision accidents and urgent situations;

The Kent shackle used in the construction process is also the final choice after comprehensive evaluation to ensure the maximum economic benefits. After taking the mentioned above works, CHINA MSAis closely paid attention to the improved system, and the safety assessment steps are fully matched the ***IALA G1018 RISK MANAGEMENT***risk assessment procedure and information flow chart of correspondence one by one, which verifies the practicality of the risk management tool.

**2.3.3 Application of mature technology and equipment**

(1) The lighted buoys all adopt the Beidou remote and monitor control lamps. The signal transmission through the Beidou system can effectively solve the signal coverage blind area problem.

(2) 8 multi-functional AtoNs were put into Qiongzhou Strait, among which the body of buoys are made of linear low-density polyethylene; The use of multifunctional AtoNs successfully realized the collection of wind direction, wind speed, visibility, flow velocity, CCTV and other data back to the background server, which can monitor and display the complex navigable environment of the Qiongzhou Strait ships routing water area in real time.

(3) The adjusted ship routing system of Qiongzhou Strait is incorporated into the E-navigation service of Southern Navigation Service Center, China MSA. The E-Navigation service complies with the international E-Navigation general framework and relevant standards. It provides information services such as maritime safety service (MS 5), meteorological information service (MS 14) and Real-time hydrological and environmental information services (MS 15).

1. **Proposal**

N/A

1. **Action requested to Committee**

The Committee is requested to note the above-mentioned information.