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Work Plan Task Number2 …………………………………

task group WG 2 ………………………

Author / submitter CHINA MSA………………

AtoN distribution adjustment practice of the main channel

in Tianjin port, China

# essentials

The proposal mainly introduces the AtoN distribution adjustment practice of the main channel in Tianjin port, China, including the context, AIS navigation, four-season universal light buoy, environmental protection, Beidou positioning and communication, integrated anti-ice lamp device and benefit analysis.

## THE PURPOSE OF THE DOCUMENT

Reviewe the proposal, and provide useful reference for the application of AIS navigation, based on the AtoN distribution adjustment practice of important ports in China.

## RELEVANT DOCUMENT

R0126 A-126- -Application of AIS Navigation in Maritime Aage Services

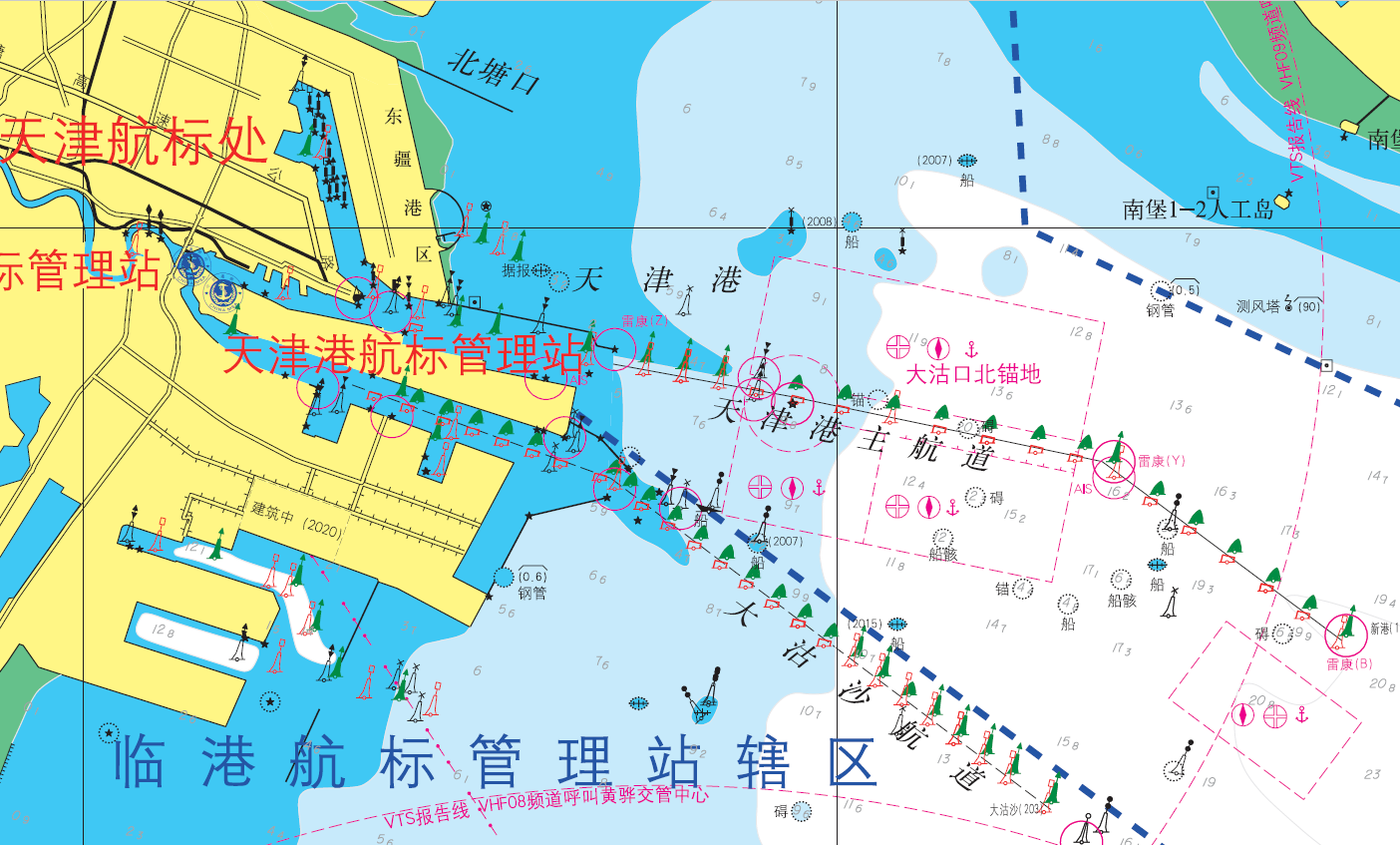
# background

Tianjin Port, China is close to the Bohai Sea, with geographical coordinates of 38°59 '08 ″ N and 117°42' 05 ″ E. It is the largest comprehensive main hub port, and one of the major ports of transshipment for energy and raw materialin northern China.Part of the main channel of Tianjin port is compound channelthe navigation environment is complex, the dift ices in winter will damage the steel ATON buoys easily, the average annual fog day of 14.6 days, and maximum of 26 days; the city background light at night is a big confusion for sailors.Therefore, it is necessary to formulate a scientific and reasonable adjustmentscheme for the ATON bouts to improve the overall efficiency of navigation assistance. There are many equipments or technologies have been mature application for many years and jointly used in Tianjin Port navigation beacon to ensure the safety of ship navigation and Marine environment protection such as AIS communication, Beidou positioning and communication, four-season general light buoy in ice area, solar power supply system, et cetera.

# A Brief Introduction of Tianjin Port Navigation Guarantee Facilities

## 3.1 ATON facilities distribution

Before the adjustment, Tianjin port compound channel distributed 87 ATON facilities, including 1 ligth house, 2 lamp piles, 71 bouys including 31 four-season universal light buoys, 8 long-term ice bouys, 24 triditional steel lamp buoys, 4 Multi-function light buoys, 4 hingde type lamp piles, 5 radar transponders, 7 physical AIS beacons, 1 virtual AIS beacon.



*Fig. 1 Navigation and distribution of main Channel of Tianjin Port*

## 3.2 AIS base station

Tianjin port main channel contains 2 AIS base station respectively built in east dike and south port, each configuration 2 SAAB R40 full function AIS base station, which realizeAIS signal comprehensive coverage in Tianjin port main channel and nearby waters , and provide both real-time and historical AIS data.Those stationplayed an important role inimproving maritime supervision efficiency,and assisting maritime investigation in Tianjin port and nearby waters .

## 3.3 Communication via [public](javascript:;) [network](javascript:;)

At the end of 2017, the Dagu Lighthouse 3G / 4G telecom communication base station was carried out for opening test and acceptance inspection.The construction and opening of Dagu Lighthouse Telecom Base Station has opened up the data communication link of the main channel east of Dagu Lighthouse and the surrounding anchorage, enhanced the coverage of the communication signal in the waters of Tianjin Port, and solved the public communication problem of Marine user in the covered area.At the same time, a dedicated bandwidth is reserved for the transmission of video monitoring and visibility equipment data on the lighthouse to better serve the sea-related users in Tianjin Port waters, according to the construction agreement of the lighthouse base station.

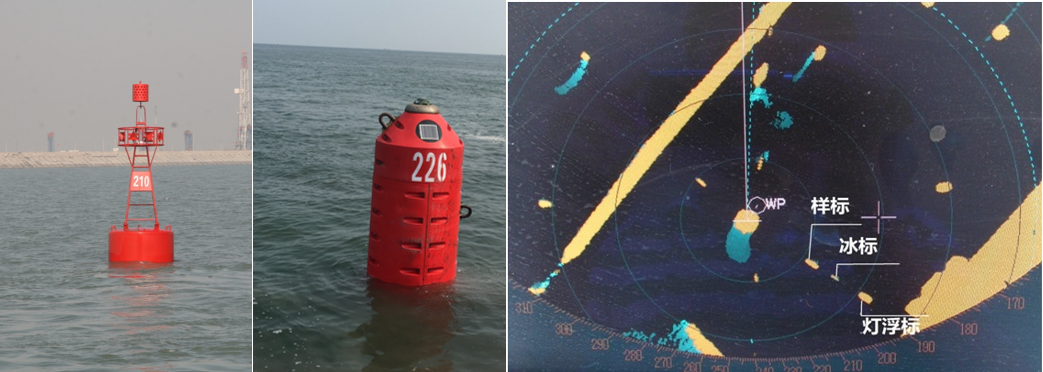
## 3.4 The Beidou CORS Station

In 2016, China had bulit 10 beidou CORS benchmark station and one area data processing service centerin Tianjin port area, which can realize the real-time "cm" level positioning service in Tianjin port area. They played an important role in dock lift, channel dredging, offshore surveying and mapping, ship berthing, submarine pipeline laying and offshore drilling platform construction and other offshore fine operation.

# Content about the AtoN distribution adjustment

## 4.1 Unified buoy system

The deep water channel of the main channel in Tianjin port uniformed 42 four-season universal light buoys, the shallow water channel uniformed conventional steel light buoys, which improved navigation efficiency in winter, navigation service in winter is exactly the same as other periods. It provide an unified system, stable and reliable navigation service throughout the year.



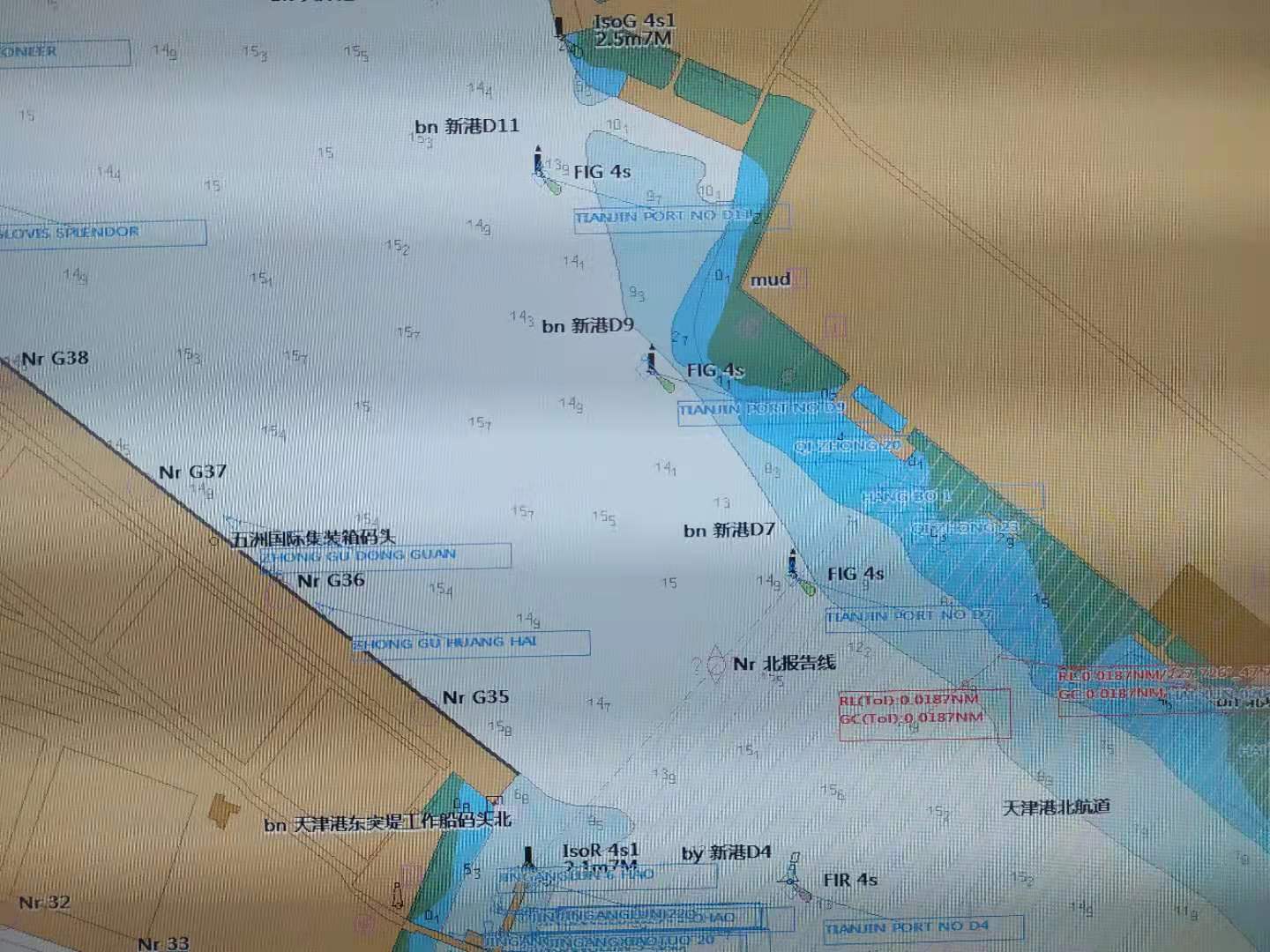
*Figure 2 conventional steel lamp buoy and four-season universal light buoy*

## 4.2 Green facilities

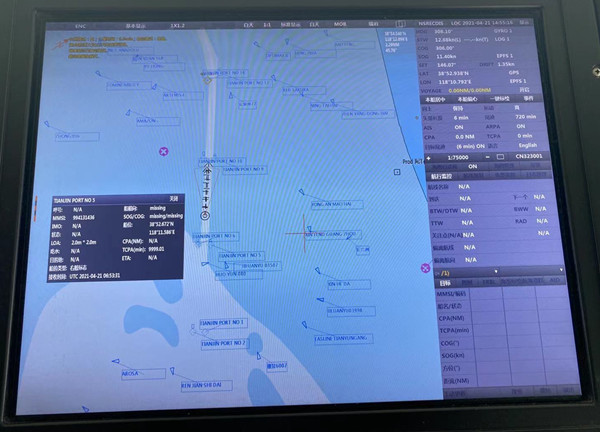
Thefour-season universal light buoy used in the deep water channel of the main channel in Tianjin port adopts solar power supply system and green polymer polyethylene body, which suppresses the marine biological pollution, eliminates the rust removal and pollution cleaning operation with the steel buoy, extends the replacement and maintenance cycle, reduces carbon dioxide emission and paint use, and helps the construction of a green port in Tianjin Port.

## 4.3 Digital facilities

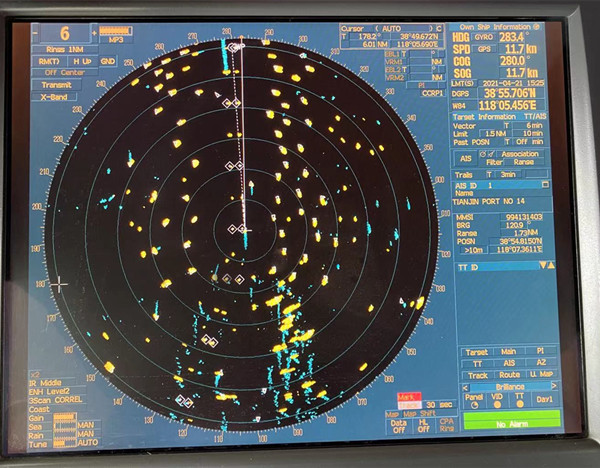
Using AIS and beidou technology to carry out the digital modification of navigation facilities in Tianjin port. We have set 35 real AIS AtoN Interval in pairs in the main channel, users can use the existing general ship navigation instruments with no further investment, realize the digital perception of traditional visual AtoN, which provide a visual plus digital navigation services, significantly improve the navigation efficiency and safety in fog, night,or bad weather in Tianjin port.



*Figure 3 Real AIS AtoN shows in ECDIS*

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*Figure 4 Information display of real AIS AtoN*

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*Figure 5. Radar display of real AIS AtoN*

## 4.4 Real-time perception

Using GPS positioning, Beidou positioning, Beidou short message communication and AIS short message communication to realize real-time sensing and remote control of the working status of AtoN in Tianjin Port, which improved the efficiency of repairing and navigation, enhanced the Shipping safety as well.

## 4.5 Multifunctional anti-ice lamp

The anti-ice lamp integrates many modules such as automatic light source control module, GPS positioning module, Beidou positioning module, Beidou communication module, AIS short message communication module, and lamp status monitormodule, to meet the ice resistance and stability level to apply in frozen ports in winter.

The internal state monitoring module alsocan monitor the internal humidity, temperature and acceleration of the lamp. During the operation process, especially the ice period, we can analyse the influnce of the dirfting ice through the internal state monitoring module to provide data support for making inspection and maintenance plan.

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*Figure 6 Multifunctional anti-ice lamp —— for* *conventional steel lamp buoy(left)and four-season universal light buoy (right)*

# benefit analysis

## 5.1 Acquisition, replacement and maintenance costs

Compared with the alternate application of conventional steel lamp buoy and ice bouy, 42 four-season universal light buoy in deep water waterways can save ¥705,600 in acquisition, ¥60,200 in replacement and ¥352,300 in maintenance. 16 conventional steel buoys in shallow water waterways can save ¥152,000 in acquisition, ¥209,600 in replacement and ¥100,700 in maintenance.respectively.

Therefore, after the adjustment, we can save ¥857,600 in acquisition, ¥869,800 in the average annual cost of replacement,and ¥453,000 in maintenance.

## 5.2 Inspection cost

The ordinary annual inspection cost is ¥492,000. After the adjustment, we don’t need to inspect the conbentional bouy once a month, we just need to do a quarterly inspection using the integratedreal AIS AtoNs, and the annual inspection fee is ¥164,000, therefore the annual inspection cost of the main waterway of Tianjin Port can be saved by ¥328,000.

## 5.3 Improve the effectiveness of AtoNs

The deep water channel of the main channel in Tianjin port uniformed 42 four-season universal light buoys, the shallow water channel uniformed conventional steel light buoys, which improved navigation efficiency in winter, navigation service in winter is exactly the same as other periods. It provide an unified system, stable and reliable navigation service throughout the year. Therefore, the number of over-water construction is also reduced, which effectively improving the navigation environment and ensuring the efficiency of port production. The integrates real AIS AtoNs realize the digital perception of traditional visual AtoN, which provide a visual plus digital navigation services, significantly improve the navigation efficiency and safety in fog, night,or bad weather in Tianjin port, and brings incalculable economic benefits to port logistics economy.

# discuss

not have.

# reference documentation

not have.

# Action requested by the Commission

Bring the committee's attention to China's work in AtoN distribution adjustment practice of the main channel in Tianjin port, hoping to provide cases for the adjustment in other ports.

1. Input papers should be assigned to a work task as listed in the Committee work plan which is available in input papers .Leave open if uncertain but consider how the paper is to be processed if not relevant to a work task [↑](#footnote-ref-1)