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

**□** DTEC **□** VTS **□** Information

Agenda item [[2]](#footnote-2) n.n

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

Author(s) / Submitter(s) China MSA

Suggestion for the Development of Guideline on Meteorological and Oceanographic Data Dissemination

# Summary

ENG 2023-2027 work programme plans to develop the guideline on meteorological and oceanographic data dissemination. ENG17 set up a task group and fully discussed the content and structure of the guideline. China MSA has carried out a wide range of multi-functional AtoN deployment and data services, in the process of active practice, China MSA is also developing relevant national standards.

## Purpose of the document

The document focuses on the task of developing the guideline on meteorological and oceanographic data dissemination in the ENG 2023-2027 work programme, and it is suggested that the guideline could adopt the relevant contents of the draft “General Specification For Multi-functional AtoN” being developed by China MSA.

## Related documents

None

# Background

With the increasing demand of Marine users for meteorological and oceanographic data, many countries are deploying the multi-functional AtoN, using AtoN as physical carriers at sea to collect meteorological and oceanographic data and providemulti-functional AtoN data services.

Due to the different purposes and functions of meteorological and oceanographic data requirements, the multi-functional AtoN applications are diverse. Because multi-functional AtoN involves an information technology application, and to integrate multi-point information collection to carry out the development of monitoring and service network, it is very necessary to guide its application of a top-level guideline, so that it can enter a benign and orderly development stage.

# Discussion

China MSA has set up a number of multi-functional AtoN in Shanghai Port, Ningbo Zhoushan Port, Guangzhou Port, Tianjin Port and other large ports, and provides comprehensive services including meteorological and oceanographic data to Marine users. According to the accumulation of experience in the application of multi-functional AtoN, China MSA is formulating the “General Specification For Multi-functional AtoN” and has completed the draft document, which regulates the application scope, deployment requirements, system composition, technical requirements and information services.

1. The application range of multi-functional AtoN includes but is not limited to navigation aid function, monitoring function and decision-making aid function.
2. The deployment principle of multi-functional AtoN is based on: functional principle, adaptability principle, extensibility principle, environmental protection principle and standardization principle.
3. The site of multi-functional AtoN :

* Important ports and waterways;
* Narrow channel;
* Port entrance and turning point;
* shoals and other areas with large changes in current;
* Environmental Monitoring Requirements area;
* Accident-prone locations.

1. The multi-functional AtoN system consists of five parts: information collection terminal, information communication terminal, information integration terminal, energy support system and information service system.
2. The technical requirements of multi-functional AtoN include communication requirements, energy requirements and installation requirements.

In terms of multi-functional AtoN data communication, China MSA has carried out an application test of BDMSS(BDMSS Message Service System) third-generation short message transmission, and the maximum byte number of BDMSS third-generation short message transmission is 14000bit (1.7K), which can normally, timely and accurately transmit multi-functional AtoN data.

1. The data service of multi-functional AtoN includes the processing of data flow, the type, category and frequency of data service provision, the data service interface, and information security.

The IALA ENG Working Group is developing guideline on meteorological and oceanographic data dissemination, which includes the scope of application, location, system composition, communications, energy, data service delivery, etc., but no specific content has been produced.

# REFERENCES

None

# ACTION REQUESTED OF THE COMMITTEE

The committee is requested to pay attention to the draft national standard of "General Specification For Multi-functional AtoN" formulated by China MSA, and adopt the relevant content in the development of the guideline on meteorological and oceanographic data dissemination.

# Annex 1-General Specification For Multi-functional AtoN(draft)

1. Applied range
   1. Navigation function

The main function of multi-functional AtoN is used for navigation, including traditional navigation and radio navigation, as well as extend the navigation function of the AtoN.

1. Visual AtoN service
2. Radio AtoN service
3. Hydrological information navigation service
4. Meteorological information navigation service
   1. Monitoring function

According to the water area where the AtoN is located, the information collection terminal is equipped according to the demand, and the monitoring function is given.

1. Atmospheric environment monitoring
2. Water quality monitoring
   1. Management function

As a physical facility in an important position on the water, the AtoN can carry the CCTV, small radar, sonar and other sensing facilities of the relevant management units, and make the AtoN as an important monitoring point on the water to give management functions.

1. Navigation safety management
2. Environmental safety management
3. Port safety management
4. Deployment requirements
   1. The principle of deployment

2.1.1 Functional principle

Multi-functional AtoN should be placed in the port of entry, channel interchange, bridge area water and other important positions. According to the user requirements and flexible configuration mode, multi-functional AtoN would carry out the multi-function selection, and achieve the modular on-demand design.

2.1.2 The principle of adaptability

The deployment of multi-functional AtoN shall be compatible with ***the* *provision on AtoN in navigable waters of China* *(GB 4696-2016)***, ***the provision on AtoN for Bridges in navigable Waters of China (GB 24418-2020)*** and ***the Provision on AtoN for underwater structures in China sea area (GB 17380-2020)***.

2.1.3 The principle of extensibility

On the basis of upgrading the traditional AtoN into a multi-functional AtoN, the basic carrying conditions such as energy and communication are reserved. Through the reserved redundant part of energy and communication, information sensing facilities other than the current requirements can be installed in the future to meet the diversified information collection needs of future development.

2.1.4 The principle of environmental protection

Energy-saving equipment, clean energy, environmentally friendly materials, etc. should be used, and environmentally friendly disposal should be done.

2.1.5 Standardization principle

Data interface, sensor loading, communication interface, service interface, physical integration interface, etc. are standardized to achieve data interconnection.

* 1. Site selection

According to the actual application requirements, the following locations should be preferred in the location selection of the multifunctional beacon:

1. Important ports and waterways;
2. Narrow channel;
3. Port entrance and turning point;
4. Shoals and other areas with large changes in current;
5. Environmental Monitoring Requirements area;
6. Accident-prone locations.
7. System composition and technical requirements
   1. System composition

Multi-functional AtoN consists of five parts: information collection terminal, information communication terminal, information integration terminal, energy support system and information service system.

3.1.1 Information collection terminal

The hydrology, meteorology, environment, monitoring and object identification and other sensors carried on the AtoN are collectively referred to as information collection terminal. The terminal include but is not limited to automatic weather station equipment, atmospheric environment monitoring station equipment, flow measuring instrument, wave meter, radiation monitoring equipment, CCTV monitoring and other sensor equipment.

3.1.2 Information communication terminal

The information collected by the sensor is transmitted through the communication link to a single or multiple communication equipment of surrounding ships and shore-based data centers, including but being not limited to AIS AtoN, Beidou telemetry terminals, 4G / 5G mobile communication terminals, VSAT satellite communication terminals, etc.

3.1.3 Information integration terminal

Information integrated terminal refers to the intelligent terminal equipment placed on the AtoN, connecting all information collection terminal, communication terminal and energy system, processing and forwarding data on the AtoN, and providing energy supply and management.

3.1.4 Energy support system

Including offshore photovoltaic, wind and other charging equipment, charging the equipped battery energy storage equipment. By connecting the information integrated terminal, it can provide energy support system for multi-functional AtoN information collection terminal, information communication terminal and information integrated terminal.

3.1.5 Information service system

The information collection terminal collects the perception information around the AtoN and transmits the information to the surrounding ships through the regional information service process. After the various data collected is sent to the shore-based data center, the API data service interface service can be provided to the relevant users, collectively referred to as the information service system.

* 1. Technical requirements

3.2.1 Communication requirements

The communication modes adopted by Multi-functional AtoN should have at least one or more of AIS, high-speed data communication (such as 4G/5G), satellite communication and Beidou short message communication.

3.2.1.1 4G / 5G communication capability

Public operators' full-band service network, and the data bandwidth is not less than 2M.

First to meet the 5G-700M communication frequency band, and downward compatible with the 4G full frequency band.

3.2.1.2 AIS communication

Per the ITU-RM.1371-5 Standard requirements implementation.

3.2.1.3 Beidou communication

According to the communication standard requirements of Beidou third-generation telemetry terminal.

3.2.1.4 Communication distance

Not less than 30Km.

3.2.1.5 Data protocol

Auxiliary navigation information is performed according to the IEC 61162-1 standard requirements. The data return protocol is implemented in accordance with the requirements of the Beidou third-generation short message standard.

3.2.2 Energy requirements

3.2.2.1 Power supply adaptability

a. AC power supply

The AC power supply rating is 220V,50Hz, when the AC voltage range is ±10% of the rated value, the frequency range is ±5% of the rated value, the multi-functional AtoN should be able to work normally.

b. DC power supply

The operating range of DC power supply should be 10V-24V.

3.2.2.2 Energy support system

The energy system mainly consists of photovoltaic modules and battery modules, and adopts the on-demand flexible configuration mode. Considering the use environment of multi-function beacon and its characteristics of low charge and low discharge, lithium-ion batteries should be used as the energy storage of the energy system.

The multi-functional AtoN uses solar panels to collect energy, and is equipped with lithium iron phosphate battery energy storage to provide a highly reliable power supply system. In the case of no solar charging, the operation time is required to be no less than 15 natural days.

According to the IALA Recommendation G1039, the energy consumption of various sensors should be calculated in virtual application scenarios.

3.2.3 Installation requirements

3.2.3.1 Standardization requirements

The installation method of each sensor device shall take into account the maintenance requirements after installation, and a standardized integrated installation method shall be adopted. Each sensor device shall be installed on a ring bracket, and the ring bracket shall be installed on the top of the AtoN in the way of flange mounting. Cable routing is fixed and bundled through pipes.

3.2.3.2 Fast and simple requirements

Based on the quick and simple installation requirements of the equipment, combined with the specific installation methods of various equipment, the connection of all equipment should adopt the installation method of industrial plug-ins to achieve standardized fast and simple integration. At the same time, manufacturers should also be required to reserve the fixed parts required for each sensor equipment to achieve follow-up quality service.

1. Information service
   1. Data flow

The information collection terminal collects the peripheral information of the AtoN and transmits the information to the information integration terminal.

The information integration terminal decodes and preprocesses the data generated by each information collection terminal on the AoN. The required data can be re-encoded locally and forwarded to specific local information communication terminal such as AIS/ Beidou, and transmits all the data to the information service system via the 4G / 5G mobile communication terminal. Then the information related to the navigation function can be broadcast or addressed to the surrounding ship through the AIS terminal.

The energy system is connected to the information integration terminal, which supplies the information collection terminal and the information communication terminal, which can manage the electrical equipment.

The shore-based data center receives and stores the complete data flow and can be provided to a third party by the API data service interface of the data center according to the requirements.

* 1. Regional information services

According to the Maritime Radio Communication Program (MRCP), the service to users should be broadcast directly by the AtoN sub-station.

4.2.1 Service mode

AIS, as one of the necessary means of navigation service, has become an indispensable device for mariner. Based on the standardization and universality of AIS, the AIS short message service mode should be used to extend the navigation information service for regional ships.

4.2.2 Information category

The navigation information of Multi-functional AtoN can be broadcast in the following messages through the entity AIS AtoN to provide extended navigation service for regional ships.

* Message 21 - Identification of navigation AIDS and the current geographical location status;
* Message 8 - Meteorological and hydrologic data or other IMO information;
* Message 12 and 14 - Navigation danger information;
* Message 6 - Binary user-defined packet information.

4.2.3 Frequency of information sending

According to the AIS message transmission rules, the following message frequency is recommended:

|  |  |  |  |
| --- | --- | --- | --- |
| No. | Message No. | Recommended sending frequency | Optional recommendation frequency |
| 1 | 21 | 3 | 3，5，6，10 |
| 2 | 8 | 10 | 3，6，10，15，30 |
| 3 | 12 | 10 | 3，6，10，15，30 |
| 4 | 14 | 10 | 3，6，10，15，30 |
| 5 | 6 | 10 | 3，6，10，15，30 |

Table 1 AIS message sending frequency

* 1. Data service interface

After receiving the data from one or more Multi-functional AtoN, the shore-based data center should store the data according to the location and the information content collected by the sensor, develop API interface in the background system, and provide location-based multiple information service to other relevant users based.

* 1. Information safety

Considering the type of data, the meteorological, hydrological and environmental data collected by the information collection terminal belong to the open data, and there is no confidentiality requirement. 4G/5G high-speed data public mobile service network and AIS communication link are used for data transmission, and Beidou short message communication link is used for remote waters. Meanwhile, information is encrypted during transmission and stored after landing in the data center.

Multi-functional AtoN information security can be managed according to ***the computer information system security protection classification criteria (GB 17859)***.

# Annex 2-BDMSS third-generation transmit multi-functional AtoN data

In November 2023, China MSA carried out a field test of BDMSS third-generation transmit multi-functional AtoN data.

1. Test location

Oubiao 2 beacon,Oujiang AtoN Station.

海上的桥

描述已自动生成

Figure 1 test location

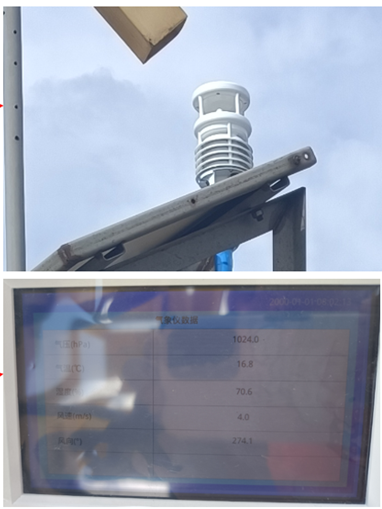
1. Test content

The equipment and sensors are mounted on the beacon to measure meteorological data and test the communication success rate and data accuracy of the BDMSS third-generation transmit multi-functional AtoN data.

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Figure 2 test equipment

1. Test screenshots and data

 图形用户界面, 表格

描述已自动生成

Figure 3 field data Figure 4 postback data

|  |  |  |  |
| --- | --- | --- | --- |
| Time | 2023-11-16 11:51 | 2023-11-16 12:00 | 2023-11-16 15:35 |
| BDMSS return temperature（℃） | 18.8 | 18.2 | 17 |
| Meteorological Office temperature（℃） | 18.3 | 17.6 | 17.2 |
| BDMSS return humidity（RH%） | 64.9 | 60.4 | 54 |
| Meteorological Office humidity（RH%） | 63 | 60 | 51 |
| BDMSS return longitude | 120°53′58.3″ | 120°53′58.2″ | 120°53′58.1″ |
| BDMSS return latitude | 27°58′45.9″ | 27°58′45.9″ | 27°58′45.7″ |

Table 1 test data sheet

1. Test conclusion

BDMSS third-generation transmission maximum number of 14000bit (1.7K), equipped with conventional sensors, a single transmission can meet the application requirements. The field test data was compared with the data in the AtoN system and the public data released by the local meteorological office at that time, and test results were normal, timely and accurate; Field test sent 252 times, received 252 times, packet loss rate 0, error rate 0, success rate 100%.

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