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

Technical Domain / Task Number 2 WG2/5.1.1…………………………

Author(s) / Submitter(s) CHINA MSA…………………………

Construction of standardized remote control and monitoring system of aids to navigation in China

# Summary

Under the guidance of G1008《Remote control and monitoring of Aids to navigation》,China MSA has been committed to the construction of remote control and monitoring system (RCMS) . After long-term research and practice,China MSA formed a set of standardization RCMS, this paper recall the developing history of RCMS in China, introduces the construction and application of the standardized RCMS, and shares some solution to solve some developing obstruction.

## Purpose of the document

The committee is invited to note the information.

## Related documents

G1008《Remote control and monitoring of Aids to navigation》

# Background

With the rapid development and wide application of electronic technology, China MSA began to introduce remote and control technology to Aton management since the mid-1990s, and the RCMS in China came into being.Currently, RCMS is able to realize long distance measurement /surveillance /control and monitoring, it contains 3 major parts:measurement and control center, remote terminal units (RTU), and communication system, the RTU obtains the local data of Aton and send it to measurement and control center, the measurement and control center run status monitoring and control upon processing received data.

Reviewing the development process of RCMS in China, it has gone through three stages: exploration, application and standardization.

Exploration stage: In the mid - 1990s, China MSA began introduced the information measurement and control technology into the Aton management. The related equipment manufacturers monitor the basic working parameters of the lamps such as position, current, and voltage by installing monitoring equipment outside the Aton, and use SMS short message communication to realize the return of monitoring the basic status of the Aton operation.

Application stage: With the popularization of mobile communication technologies, GPRS was adopted by the RCMS in the early 21st century. The data communication is more convenient and stable. At the same time, lamps integrated with telemetry remote control terminal were developed.

Standardization stage: A technical Specifications for RCMS (JT / T788-2010) was issued in China , which stipulates the composition, function, technical requirements, test methods and inspection rules of RCMS. Each Aton management agency develops the corresponding system with reference to this standard, and the quality of RCMS has been improved greatly.

The use of RCMS in Aton management improves the reliability of Aton operation, enhances the ability of Aton management personnel to perceive the operational status of Aton, and prolongs the Aton mean time to repair(MTTR). For many years, the Aton RMCA has been deeply used at all levels in China. It has played an important role in reducing maintenance costs, improving Aton maintenance efficiency.

# Discussion

Since there may be multiple stakeholders involved in the construction of the RCMS, the interests of various stakeholders are inconsistent, the types of Aton that chosen to be monitored are diverse, the data to be detected may not necessarily be the same, and communication protocols are diverse as well. In the early stage of RCMS construction, lack of a unified standard results in several disadvantages:

1. Low quality of remote and monitor data. At the beginning, due to market competition, each manufacturer regulates the type, accuracy, and format of the data, and formed barriers as much as possible. As a result, the types, data items, measurement units, sampling accuracy, and maximum sampling error of the data collected were different.
2. Low reliability of communication. In the process of manufacturers promoted RCMS, various manufacturers gradually formed different communication protocol systems due to market competition. At the early stage, there were as many as 25 communication protocols in China. As a result, the management department need to configure different protocols of different manufacturers. Terminal manufacturers also need to configure multiple protocols.What is more, the cost of protocol update was high, and the renew period of protocol was long.
3. The data service capabilities are limited. When the management department monitored the operation status of the Aton, it is necessary to understand not only its dynamic information, but also the static and management data of the Aton. the Aton telemetry and remote control information of different manufacturers cannot be interconnected, and the dynamic, static and management data information was isolated on the site, which leaded to the limited external service capabilities of the data.
4. The function of the system is restricted. The RCMS developed by the manufacturer became a subsidiary of the Aton telemetry and remote control terminal, resulting in insufficient power for the manufacturer to update the system and it became a single system function.

## Standardization of RCMS in China

In order to solve mentioned problem, Navigation Guarantee Center of South China Sea (NGCS ) of China MSA constructed standardize RCMS through below methods:

1. Formulating data exchange standard. The NGCS conduct data research of Aton information from top to bottom, put forward the idea of standardized "Data Element", and formulate the data model of data element, and standardize data exchange methods of database.
2. Unified Aton data collection specification. the NGCS carried out a research on the standardization of Aton data. The standard regulates the collection of navigation data from the types of data and the sampling measurement, including sampling accuracy, longest sampling time, maximum sampling error.
3. Standardize communication method. For communication protocol of the RCMS, the NGCS carry out a research to standardize the communication mode, interaction mode, and message format between the server and RTU.
4. Classification and grading of monitoring data.According to the importance of telemetry and remote control data, the data are classified and graded according to actual management needs, and the reporting or polling interval is optimized accordingly.
5. Specify the type of interaction between the server and the terminal. The interaction mode with the terminal is subdivided into 8 categories: ① The server queries the terminal operating status information at one time, ② The server continuously queries the terminal operating status information, ③ The server sets the terminal operating status parameters, ④ The terminal actively reports the operating status alarm information, ⑤ The terminal uploads the first-level status parameter data, ⑥ the terminal uploads the second-level status parameter data, ⑦ the terminal uploads the third-level status parameter data, ⑧ the terminal uploads the fourth-level status parameter data.
6. Standardize the format of telemetry and remote control messages. According to the interaction mode between the server and the terminal, regulate the content of the data message . The terminal manufacturer is required to package the telemetry and remote control data according to the standardized message and fill it in the communication protocol under the communication channel for transmission. As shown in Figure 1.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frame format | Start character | Identifier | Package | | | transfer method | Data field | Padding | Checksum | Ending |
| Statements | Statement number | Identification Number |
| Content | ⑴ | ⑵ | ⑶ | ⑷ | ⑸ | ⑹ | ⑺ | ⑻ | ⑼ | ⑽ |
| the data shows | Fixed-length header | | | | | | User data | | Check code | Fixed  footer |

NMEA-0183

Beidou Interface Protocol 4.0

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Instructions / Content | Length | User address | information  According to the navigation data, telemetry and remote monitoring data items, the message data is arranged in standardized form. | | | | | Checksum |
| Information category | User address | Message length | Whether to answer | Message content |
| ⑴ | ⑵ | ⑶ | ⑷ | ⑸ | ⑹ | ⑺ | ⑻ | ⑼ |

Figure 1 Message structure of RCMS signal

1. Standardize the data service interface. In order to improve the efficiency of data conversion, and improve the compatibility and openness of RCMS, NGCS unified RCMS data input and output information format . Shown as table 1.

|  |  |  |  |
| --- | --- | --- | --- |
| Serial number | interface name | request url | request type |
| 1 | Basic data interface of Aton | Get Date base | POST |
| …… | …… | …… | …… |
| 20 | Telemetry command sending interface | Sendtelemetrycmd | POST |
| 21 | Remote command sending interface | Sendtelecontrolcmd | POST |
| …… | …… | …… | …… |
| 50 | Aton operation failure | Getalarm | POST |
| 51 | Number of failures in Aton operation | Getalarmcount | POST |

Table 1 Schematic diagram of standardized data service interface

In order to further promote the standardization of RCMS, fully realize "unified data, unified communication, unified access, and unified monitoring", NCGS has launch a new generation of RCMS. The new RCMS has the characteristics of unified data format/interface format/detection format, compatible with wireless network, AIS, Beidou, GPS,maritime satellite, etc.

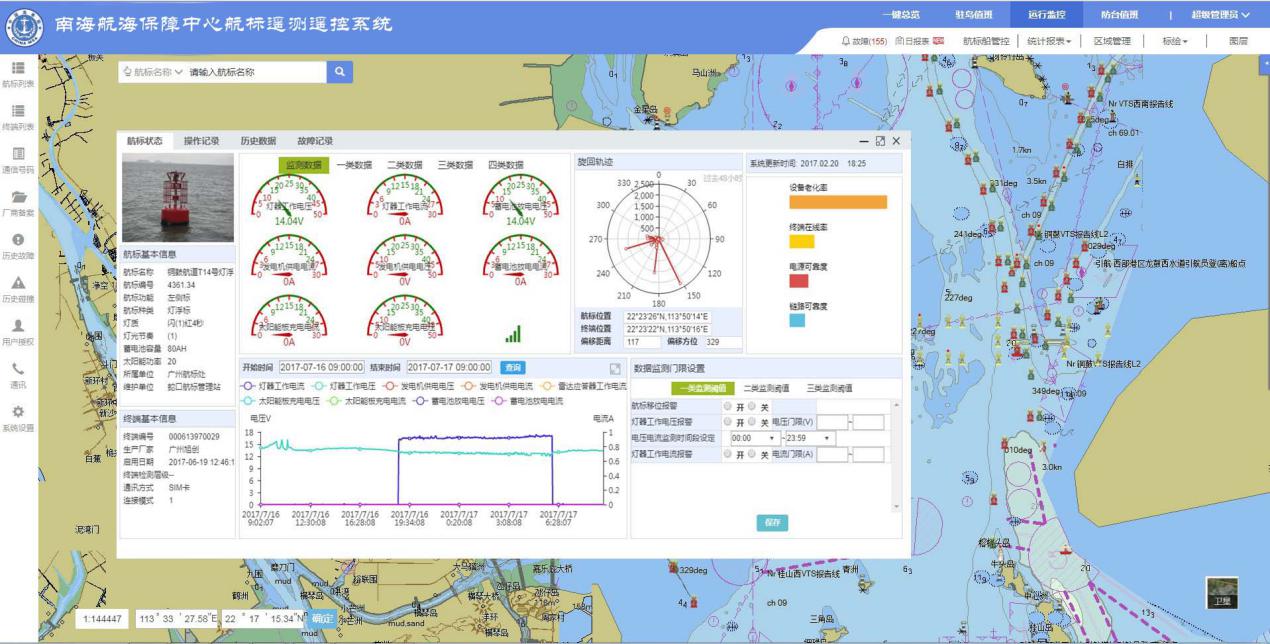


Figure 2. Web page of RCMS(Aton monitoring)

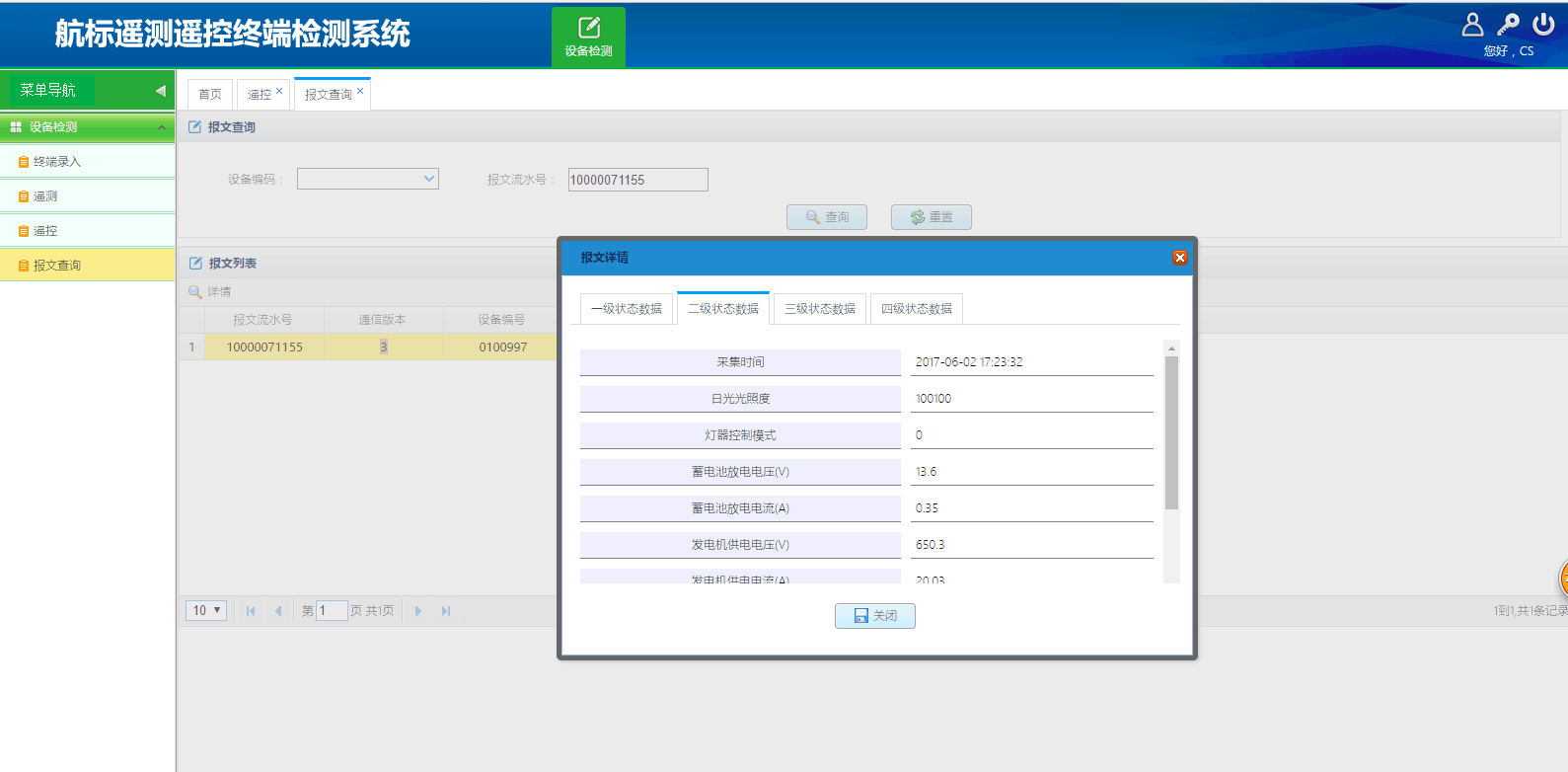


Figure 3 Web page of RCMS(RTU testing)

The developed RCMS has been fully used in the South China Sea. Up to December 31, 2019, the system had 255 users, 16 system manufacturer users, and the user's annual system click rate reached 126,253 times. The number of Aton in the whole sea area is 2,250, and the number of remote control terminals installed is 1,716, accounting for 76.3% of the total.

# References

G1008《remote control and monitoring of aids to navigation》

# Request for action by the committee

The committee is invited to note the information and take action as appropriate.

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