

# Application analysis of integrated beacon light

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Abstract: This paper briefly introduces the integrated beacon light. According to the use of integrated beacon lights in recent years, its application effect was analyzed, and several common problems such as structural damage, time-out of telemetry devices, no signal problems, large positioning errors of beacon lights, and lights not working at night were put forward. There are several suggestions for improvement are put forward.

Key words : application analysis; integrated beacon light; improvement suggestion

introduction

There are many coastal ports in Jiangsu, and there are tens of thousands of ships. In order to ensure the navigation safety of ships entering and leaving the port, the channel should be equipped with a large number of visual navigation aids, radio navigation aids, AIS ship automatic identification system and other navigation aids. Among them, visual beacons and radio beacons are the most important. In the daytime, light buoys are arranged on both sides of the channel to draw a safe road for passing ships. At night, the shining beacon lights are the best compass for ships at sea. The radio beacons can ensure that the sailing ships do not lose their way.

In the past, visual navigation aids and radio navigation aids at sea were assembled by a series of equipment such as light buoys , beacon lights, batteries, solar panels, and telemetry and remote control devices. Due to the complicated installation environment and many installation locations of solar beacon lights, and Independently distributed on the channel, after being placed, it operates independently. When the solar beacon light works for a long time, it is easy to be damaged by passing ships, and it is prone to failure. After the failure, there is also a lack of monitoring measures. In order to check whether the solar beacon light is working normally, the traditional method is to send people to the site to inspect regularly. Due to the scattered placement and long distance, there are many places to be inspected. Because the collision of solar beacons is random, the patrol and maintenance of solar beacons lacks purpose, and a large number of cruise ships and escorts need to be dispatched. In order to enhance the reliable work of beacon lights, the maintenance of a beacon light requires multiple round trips, which not only lacks purpose and accuracy, but also costs a lot for ships and personnel. It has poor performance and brings serious safety hazards to shipping. <sup>[1]</sup> With the progress of the times and the continuous development and innovation of science and technology, many domestic and foreign manufacturers of beacon equipment have focused on the integration and miniaturization of equipment, producing beacon lights, batteries, solar panels, telemetry and remote control. The device is integrated on the integrated beacon light. This article will list the use of the integrated

beacon light in recent years, analyze it and put forward suggestions for improvement.

i. Introduction of integrated beacon lights

integrated solar beacon light is an organic combination of all the equipment of the past beacon light decentralized assembly structure in terms of process and structure design to form a relatively complete new type of beacon light. Most of this type of beacon lights are composed of base, lamp housing, lens, lithium battery, LED light source, positioning module , control system and other parts. Among them, the base is in the shape of a cone or a polygonal cone, and the monocrystalline silicon solar panel and the lens are integrated to form a whole, and some solar panels are added on the top, so as to form a comprehensive sunlight reception and all-weather charging, all equipment is placed in it, and the maintenance sealed state. It has the advantages of compact and beautiful structure, small size, light weight, multi-function, stable performance, high photoelectric effect, and convenient installation.

The integrated beacon light installation and daily maintenance work is simple and easy. First, because of its reliable performance and monitoring and monitoring, it can reduce the number of manual cruise inspections, improve the efficiency of beacon maintenance, save the cost of beacon maintenance, and reduce the labor intensity of workers. Second, the integrated beacon light has high brightness and low energy consumption, which meets the requirements of the era of energy saving, environmental protection, economy and practicality.

ii. Application situation analysis

The integrated beacon light has been popularized and used for several years. According to the actual use situation at sea in recent years, the integrated beacon light system has improved stability and failure rate compared with the traditional solar beacon light system, but the failure situation It is still common to focus on a few issues. The following will analyze the most frequently occurring centralized failures: structural damage, time-out of the telemetry device, no signal problem, large positioning error of the beacon light, and the light device does not work at night .

1. Structural damage

Due to the sailing of ships at sea, it is inevitable that the hull will collide with the light buoy. The integrated beacon light installed on the top is hit by a huge force, which is very prone to damage, failure or even loss. It is found from the crashed lamps recovered in the past that the overall breakage of the screw holes often occurs, resulting in the lamps falling off the lamp buoys and losing their navigation aids even though the lamp has no functional failure, thus losing the navigation aids, and even breaking the base during transportation. and so on. In addition, there

will be cases where the solar charging panel is damaged by force. Because some beacon lights use an unfolded solar panel design in order to obtain higher photoelectric conversion efficiency, once it is hit by a ship, the solar panel will be damaged and fail with a high probability.

## 2. The telemetry device times out, no signal

This problem occurs with all models of integrated lights, and the situation is different. It is possible during the day and night, and there is no uniform rule. The biggest possibility is that the program control is crash. At this time, it is only necessary to restart the lamp to resume normal operation. In some cases, restarting at sea has no effect. When the fault light device is removed to land, the telemetry model returns to normal. This situation is likely to be due to the remote location of the light float at sea and a certain displacement, sea conditions, atmospheric cloud conditions are not good, causing the lamp to leave the radiation range of the satellite or the signal is weak and cannot work properly.

## 3. The positioning error of the beacon light is large

This is because the use of satellite positioning systems on beacons for pseudo-range differential positioning will be affected by the module's own errors, electromagnetic interference during transmission, lightning, heavy rain and water surface reflections, which limit the improvement of its positioning accuracy. The factors that mainly affect its accuracy can be roughly divided into three categories: errors related to satellites, errors related to signal propagation, and errors related to receiving equipment. It increases with the distance from the station to the base station, and no method of positioning can eliminate it. Errors associated with receiving equipment are process errors and generally difficult to eliminate. The main errors caused by the signal propagation process are as follows: <sup>[2]</sup>

1) Ionospheric refraction. Due to the existence of a large number of free electrons and ions in the ionosphere above the earth, the electromagnetic wave has a refraction effect, and the propagation speed of the satellite signal changes when it passes through the ionosphere. The error caused by this is called the ionospheric refraction error.

2) Tropospheric refraction. Since the troposphere obtains radiant heat energy from the ground, with the increase of height from the ground, the temperature decreases, and when the satellite signal passes through the troposphere, its propagation path will bend, and the error caused by this method is called tropospheric refraction error.

3) Multipath effect. Due to the complex and changeable environment around the receiver, the water is easy to reflect the satellite signal, and the reflected signal is easy to enter the receiver through the antenna and interfere with the received satellite signal. The error caused by this is called multipath effect error.

## 3. Night light does not work

This problem is not under the premise of external damage. First, due to the long-term cloudy and rainy weather, the solar radiation is not strong enough during the day, and the internal battery of the lamp is not sufficiently charged. Second, the battery has a long service life, the structure is aging, and the charging and discharging capacity is insufficient, which makes it unable to work normally at night.

### iii. Suggestions for Improvement

Based on the current overall usage, the following suggestions for improvement are proposed:

For the problem of structural damage, the lamp base is simple in structure and the material used is insufficient in strength. The design of reinforcing rib can be added to the connection position between the lamp body and the base to strengthen the strength structurally, or the shell material can be replaced with metal to ensure its strength.

For the problems of communication timeout, no signal, and large positioning error, using intelligent Beidou antenna and compatible modules and single-board computers enables the lamp to determine the angle status and monitoring power of terminals and satellites in real time, accurately determine the strength of communication signals, and achieve real-time analysis and judgment. Enable low-elevation power compensation as needed, reasonably select and allocate transmission nodes, apply Beidou communication function, and transmit data directly to the monitoring server background through Beidou satellite forwarding, without forwarding through the server background of any third-party operator, to avoid data transmission loss during the transmission process. Or use the composite positioning module to perform algorithm analysis on different positioning structures to optimize the use effect and improve the positioning accuracy.

For the problem of battery undervoltage, the use of high-performance lithium batteries and high-conversion solar panels can ensure the stable operation of the lamp .

### Epilogue

With the continuous progress of science and technology, the integrated beacon lights will also become more and more perfect, and the application scenarios will be more extensive. After continuous use, summarization and improvement, the current problems and technical difficulties will be solved, and the integrated navigation beacon light that is perfectly suitable for the main waterway waters will definitely appear.

### references

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