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## **Study on the Types and the Performance of Maintenance Ship of Chinese Offshore Wind Farm**

Yue Chen Song Yu Yunping Xie

Jiangsu University of Science and Technology

### **Abstract**

The operation and maintenance of offshore wind turbine is directly related to the benefit of the operation of wind farm. The study on various ship types and properties of maintenance ship in wind farm has great practical significance to improve the operating efficiency of offshore wind farm.

According to the requirements of the use of offshore wind farm and combing the characteristics of catamaran ship and multi hull ship, this paper designed some types of catamaran and trimaran as offshore wind farm maintenance ships. And the paper has conducted the numerical simulation and ship model test for some of these ships, so as to obtain the maintenance ships meeting the using requirements and having good performance.

With the development and improvement of wind farm, the maintenance ships still need further research and improvement.

### **Objectives**

With the shortage of global energy and environmental pollution becoming more and more serious, wind energy as the non-polluting renewable energy, its development and usage is watched by the governments closely. Now china has built 100MW Donghai Bridge offshore wind farm, and the wind turbine will achieve 5GW in 2015.

The operation and maintenance of offshore wind turbine is directly related to the benefit of the operation of wind farm. The study on various ship types and properties of maintenance ship in wind farm has great practical significance to improve the operating efficiency of offshore wind farm.

## Methods

According to the requirements of the use of offshore wind farm and combing the characteristics of catamaran ship and multi hull ship, this paper designed some types of catamaran and trimaran which have high speed and good performance of stability and seakeeping as offshore wind farm maintenance ships.

On the one hand, numerical simulation analysis of the resistance was conducted according to the demihull geometry of catamaran and the demihulls relative position of trimaran. Preliminary evaluation of the designment of the ship and effect of position of the sheet to the ship performance was obtained through. At the same time the numerical simulation provide a reference for ship model test. On the other hand, ship model test was conducted for some of the ships. Combining the results of the numerical simulation and test, this paper finally got the maintenance ships meeting the using requirements and having good performance.

## Results

### 1、Ship types research

#### (1) Conventional catamaran

Conventional catamaran has two identical linear and symmetric parallel arranged demihull. The two demihulls is connected by a connecting bridge, and the demihulls transverse section has the shape of round bilge, and it has a square stern.

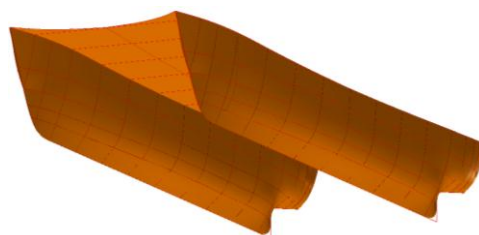


Fig.1 Conventional catamaran

(2) Improved catamaran based on wave piercing catamaran

The bow of ship is deep V-convex type, and the first keel before 7.5 station sinks below the baseline. The transverse section of the sunk has the shape similar to the water-drop. The bow ship line has the narrowest width in the designing draft position, and the bow transverse lines have the shape similar to the vase.

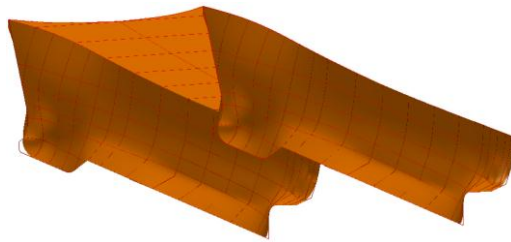


Fig.2 Improved catamaran based on wave piercing catamaran

(3) Catamaran with big globular bow and stern

Based on conventional catamaran and absorbing the advantages of the SWATH, this type of ship has big globular bow and stern to get a good fast performance and Seakeeping performance.

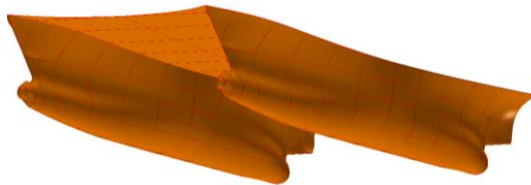


Fig.3 Catamaran with big globular bow and stern

(4) Trimaran

The main hull of the ship and two side hull is connected with the connecting bridge. Considering from the rapidity, the main hull uses the shape of round bilge and it has the square stern. The shape of the semihull is about same with the main hull.

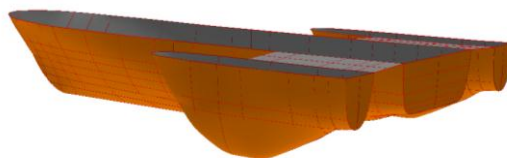


Fig.4 Trimaran

## 2、 Simulation study

For the catamaran, respectively, simulation research of resistance has been conducted for conventional catamaran, improved catamaran based on wave piercing catamaran and the catamaran with big globular bow and stern. At the same time, different length of globular bow and stern, simulation research of resistance has been conducted for the catamaran with big globular bow and stern.

For the trimaran, simulation research of resistance has been conducted according to the different size of semihull and different relative position of main and side hulls.

## 3、 Ship model test research

Ship model tests of resistance have conducted for the catamaran with big globular bow and stern and the trimaran with the different relative position of main and side hulls.



Fig.5 Ship model of the catamaran with big globular bow and stern

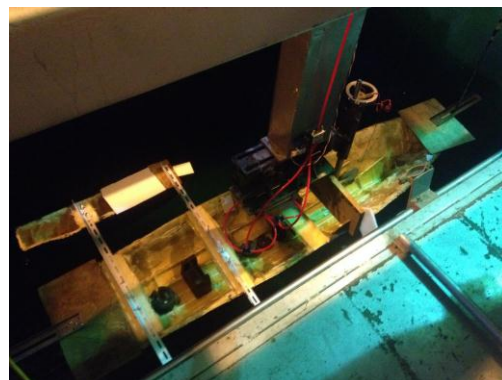


Fig.6 Ship model test of trimaran

## **Conclusions**

Offshore wind farm maintenance ship is the essential tool for offshore wind power equipment to operate normally. In recent years, China has acquired some achievements of the research on the wind farm maintenance ship.

With the extending of offshore wind farm, wind farm will encounter more complex sea state, so it needs new types of ship in order to adapt to the different working conditions, for example multi hull ships, amphibious ships and so on. At the same time, it needs to consider the performance of the maintenance ship in complex sea conditions and to accurately evaluate related performance of the maintenance ship. So it can better service for wind farm.