HYDRODYNAMIC PERFORMANCE OF NEIL PRYDE RS: X AND MISTRAL SAILBOARD

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After Olympic Games in 2004, the once used board, MISTRAL (M), in Olympic Game has been substituted with NEIL PRYDE RS：X (NP). To meet the need of the national sailing team, the research group carried out the experiments on the hydrodynamic performance of the NP and M early or later. The resistances, transverse forces and wrest moments were measured by using the balance of the trisection force, the angle of the heel and pitch was measured by using the angle sensor. The sailboard could rise and sink freely, the pitch was free, the static angle could be adjusted by utilizing the weight and the balance was at the mast. The results showed that the resistance of NP sailboard was bigger as soon as the pitch angle was bigger and this was the same as that of M sailboard, the heel did not have any influence on the resistance of NP sailboard, the resistance became small continuously when the angle of the centerboard decreased and the resistance increased as the sailboard was heavier.

KEY WORDS：sailing, resistance, different

INTRODUCTION:

After Olympic Games in 2004, the Olympic competitive sailboard of M will be replaced by NP. Up to now, there has been little research on the hydrodynamic performance of NP sailboard, including the optimal heel and pitch angle, etc. Some research deal with the hydrodynamics of the other classes of the Olympic Game (Ma, Zheng & Han, 2005; Courser & Deane, 1999). The article studied that the hydrodynamic performance of NP sailboard and the comparisons with that of M sailboard.

METHOD:

Experiments of the hydrodynamic performance of M and NP sailboard were done respectively in the international towing tank laboratory (the tank is the member of the ITTC) (Ge, 2004). The experiment was carried out at nine states about M sailboard and eight states about NP sailboard. The tonnage of M and NP sailboard were 98kg and 90kg. At every state, the resistance, transverse forces, the angle of the heel and pitch of sailboard were measured. The resistances, transverse forces and wrest moments were measured by the balance of the trisection force, the angle of the heel and pitch was measured by the angle sensor. The sailboard could rise and sink freely; the pitch was free; and the static angle could be adjusted by ballast as the balance was put at the mast (Richards, Johnson & Stanton, 2001; Subramani, Paterson & Stern, 2000).

RESULTS:

The resistance of NP and M sailboard related to the velocity in the different angles of the pitch, heel and centreboard and the different tonnages are summarized graphically in Figure 1-4.

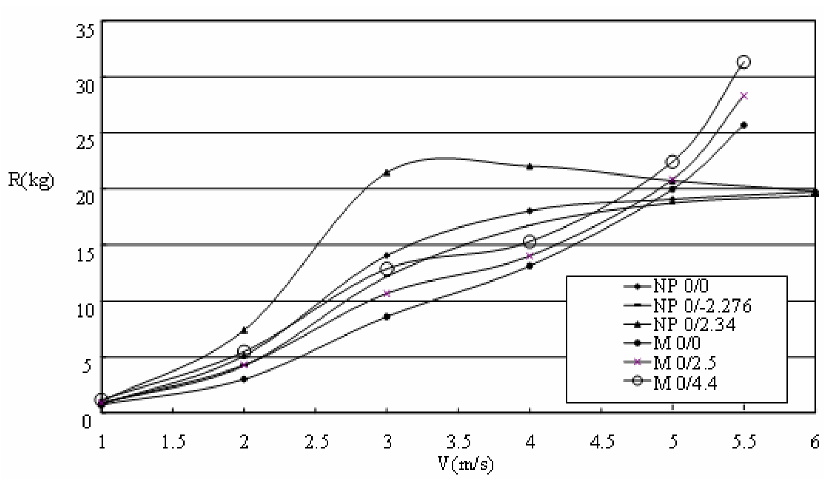

Figure 1: the resistance of NP and M sailboard related to the velocity in the different angles of the pitch

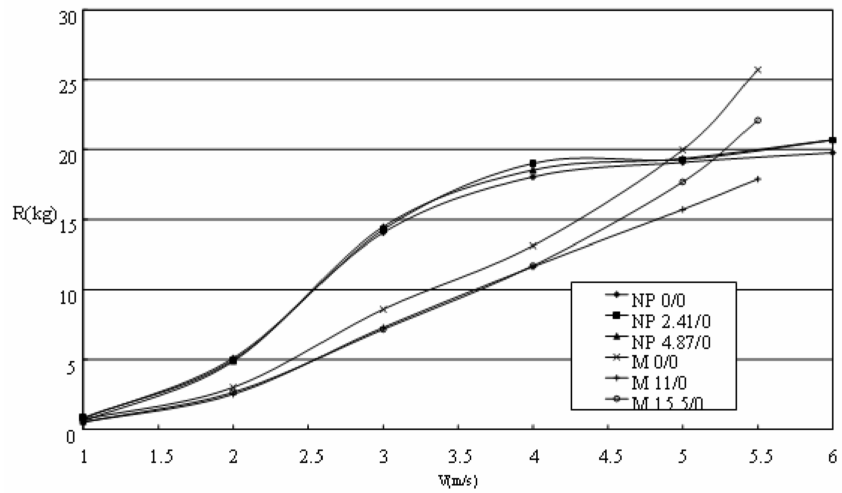

Figure 3: the resistance of NP and M sailboard related to the velocity in the different angles of the heel

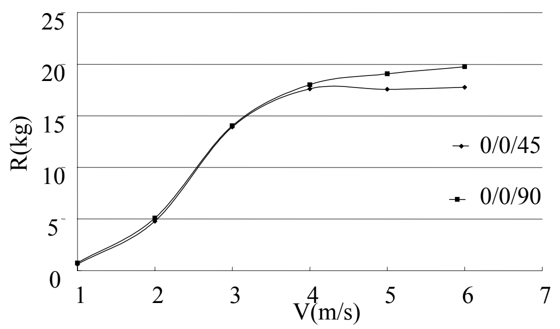

Figure 5: the resistance of NP sailboard related to the velocity in the different angles of the centreboard

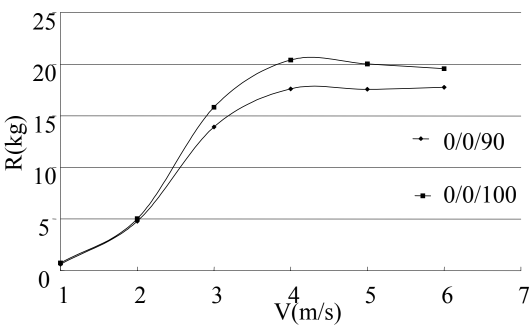

Figure 6: the resistance of NP sailboard related to the velocity in the different tonnages

DISCUSSION:

The pitch influence: The experimental results showed that the resistance of NP sailboard was bigger as soon as the pitch angle was bigger (Figure 1) and the case in M sailboard was the same (Figure 2). That reason was that the level individual became bigger and bigger when the angle of the pitch of the sailboard increased. So it was necessary that the angle of the pitch of the sailboard should be controlled properly. In Figure 3, Thought the static angle of the pitch of the sailboard was negative (the stem of the sailboard submerged), the resistance of the NP sailboard was lower when the speed was 1- 6m/s. The negative static angle of the pitch couldn't be too big or the stem would submerge excessively. If the negative static angle of the pitch was about 2.2 degree and the velocity was about 6m/s, the angle of the pitch would be about 5.5 degree and the resistance would be smaller.

The heel influence: In Figure 3, the heel did not have any influence on the resistance of NP sailboard; the resistance almost kept the same as velocity of the sailboard was less than 3m/s and increased a little as the velocity of the sailboard was more than 3m/s. In Figure 4, the resistance of M sailboard commonly decreased when the heel angle becomed bigger, but increased when the heel angle exceeded the limitation. That reason was that the upside stern of the sailboard contacted the water, which caused the inrease in the resistance .

The centreboard influence: In Figure 5, the resistance became small continously when the angle of the centerboard decreased, and the velocity is exactly more than 4m/s. So, after the sailboard runs, the centerboard should be taken up.

The tonnage influence: In Figure 6, when the weight increased by 11%, the resistance increased by about 14% at the speed of 5m/s. When the velocity was about 4m/s, the resistance increased rapidly. When the velocity was about 6m/s, the resistance increased slowly. The reason was that the resistance increased when the draft and the wet area became bigger in case that the sailboard increased.

CONCLUSION:

The experimental results showed that the resistance of NP sailboard was bigger as soon as the pitch angle was bigger and this was the same as that of M sailboard. The heel did not have any influence on the resistance of NP sailboard. The resistance almost kept the same as velocity of the sailboard was less than 3m/s and increased a little as the velocity of the sailboard was more than 3m/s. Tthe resistance of M sailboard decreased commonly when the heel angle became bigger, but increased when the heel angle exceeded the limitation. The resistance became small continously when the angle of the centerboard decreased and exactly the velocity was more than 4m/s. The resistance increased as the sailboard was heavier.The results can be used as the scientific reference not only to seek for the optimal heel and pitch position, but also control the sailboard and to prompt the speed for the athletes as well.

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