

APPLICATION OF MODERN COMPUTER TECHNOLOGY FOR PRODUCTION OF OLD TYPES OF SHIPS

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ABSTRACT

There is an increased number of orders for replicas of old ships that are used as tourist attractions in Croatia, which are also fully operational as well. The paper presents possibilities for application of modern CAD/CAM naval architecture software in production of old types of ships. Modern software can be used for geometry modeling and calculation of ship properties like stability, resistance and speed. The programs Maxsurf Pro, Hydromax and Hullspeed are applied to model and calculate hull properties of the replica of galleon 'Tirena' that was originally built in Dubrovnik in 16th century. The paper shows how computer programs can be relatively easily used to model hull form, but for estimation of some galleon properties these did not give satisfactory results.

Keywords: galleon production, galleon performance, CAD/CAM software.

1. INTRODUCTION

The small shipbuilding industry in Croatia grows every year, despite to recession and economic crises in the region and in the world. Croatia is well known as a tourist destination and there has been an increase in a number of orders for building attractive replicas old types of ships such as *trabaculs*, *caravels*, *falkuša*, *galleons*, etc. These ships are commonly built based on traditional knowledge, some historical data and very old drawings. They present tourist attractions but they also have to be fully operational because owners want to use them for excursions and cruises along Croatia's coast. Therefore, these ships can only be replicas regarding their look and shape since they have to incorporate facilities like toilets or kitchen appliances, etc. for tourist accommodation as well as diesel engines, power generators and various auxiliary machinery for operational purposes and safety. This combination of project demands presents a great challenge for designers, engineers and shipbuilders.

2. GALLEON PRODUCTION

Figure 1 shows an old painting of a galleon built in Dubrovnik in 16th century and its replica - galleon 'Tirena' built by shipyard 'Loger' at Krilo jesenice in Croatia. This very complex and demanding venture was also a very expensive one: around one mil. €. The high cost of production was partially due to very limited data about galleon structure and performance. Hence, most of the rearrangements, necessary for modern use, were made based on skills and experience of shipbuilders in building the

wooden boats of all kinds. This approach has resulted in a very time consuming production and many on-site assumptions that led to unsatisfactory performance.

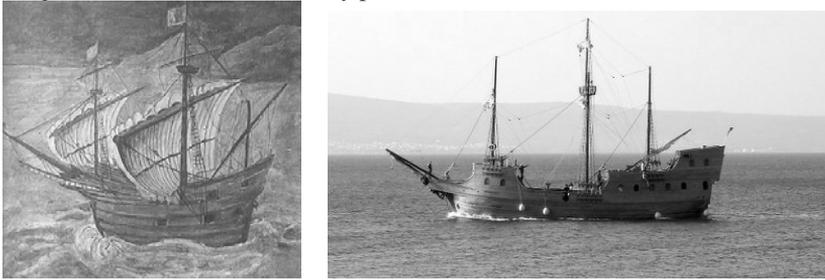


Figure 1. Left: galleon - 16th century [1]; Right: replica 'Tirena' on voyage in Adriatic Sea



Figure 2. Building site and wooden structure of galleon 'Tirena'

Main characteristics of the galleon: length (L) = 24.937 m, breadth (B) = 7.142 m, draught (T) = 2.848 m, displacement coefficient (Cb) = 0,487.

3. APPLICATION OF CAD/CAM SOFTWARE

Attempt was made to apply modern CAD/CAM software in order to fasten planing and pre-production phases and to estimate properties, like stability and speed, of the galleon. The programs used were Maxsurf Pro for geometry modeling [2], Hydromax [3] for stability calculations and Hullspeed for hull resistance estimation [4]. Figure 3 shows hull lines imported in Maxsurf and figure 4 shows results of Maxsurf geometry modeling.

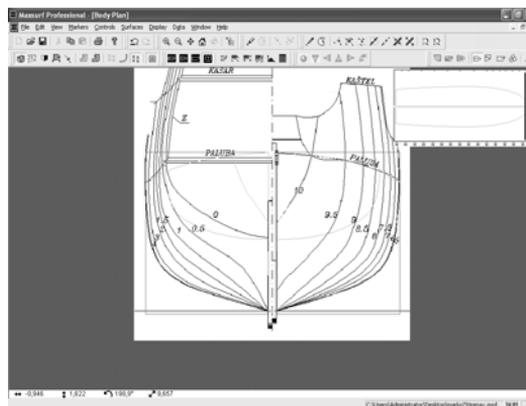


Figure 3. Body plan (hull lines) in Maxsurf

The hull form was fairly complicated to model in Maxsurf since galleon, like most of the old types of ships, has hull lines with long round curvatures. Satisfactory precision was achieved in time scale of a few weeks. Once when the initial model was made it was relatively easy and fast to remodel the hull to desired shape.

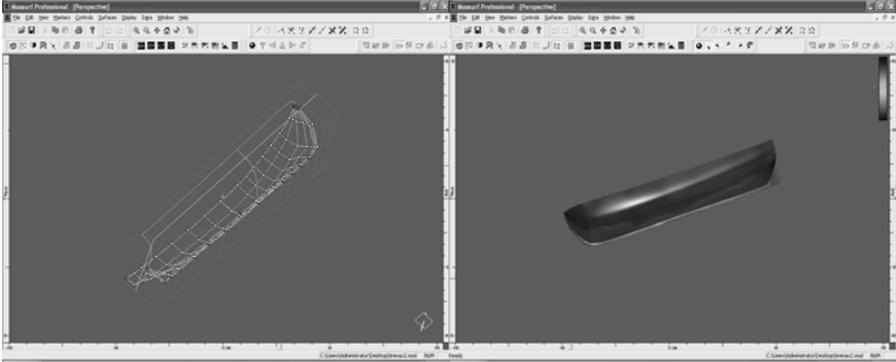


Figure 4. CAD model of galleon 'Tirena'. Left: wireframe model; Right: 3D model

Geometry modeling in Maxsurf is also a preparation for calculation of ship properties. The model can be imported to Hydromax for stability calculations and to Hullspeed for hull resistance calculation and speed estimation. Stability calculations took about two weeks which was satisfactory especially compared to situation in real production where such calculations were only provisional. Figure 5. shows results of application of Hullspeed software.

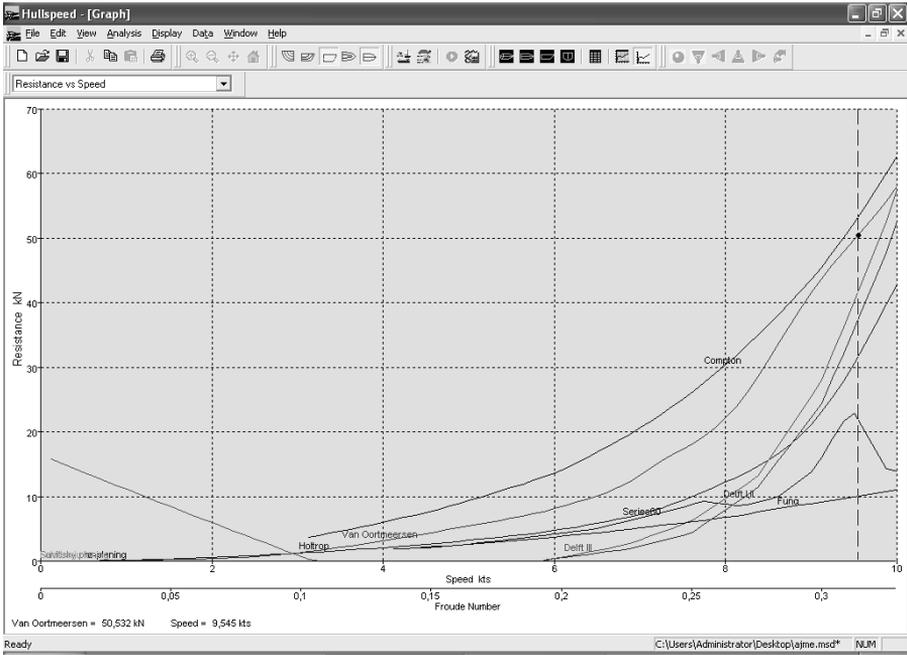


Figure 5. Results of the hull resistance calculation (Hullspeed)

Galleon's hull shape is everything but a standard. All methods for resistance calculation that were on disposal in Hullspeed, and many other similar programs, were not adequate for application in this case.

Since galleon's hull form is full displacement type of form it was expected that procedures and algorithms for these type of ships would give satisfactory estimations of power, resistance and speed.

4. CONCLUSION

This investigation showed how modern software technology can be applied in production of complex products like replicas of old ships. The complexity of the production is due to unknown data and demands for utilization of this kind of ships in modern tourism industry. Cost of the production could be significantly reduced by application of modern CAD/CAM software particularly in planing phase, a few weeks for geometry modeling compared to a few months without use of CAD software. The costs could be additionally reduced in cases when necessity for changes in hull design arise during building. Using software for calculation of ship stability also could fasten overall production process. The procedure for stability calculation is relatively simple and straightforward once when geometry model has been finished. Calculation of ship resistance and speed, however, showed that modern software lacks adequate algorithms for old types of ships, and although Hullspeed provided some results (Figure 4.) they were not in accordance with real performance of the finished ship.

5. REFERENCES

- [1] Maritime museum Dubrovnik: Galleon.
- [2] Maxsurf Pro, version 15.01. Formation Design Systems, 2010.
- [3] Hydromax, version 15.01. Formation Design Systems, 2010.
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