INTRODUCTION

In 1939 the Lund’s shipyard – a company in Ekenäs, South Sweden – launched a wooden gaff ketch built for sail-training. The vessel – inspired by general Mariusz Zaruski – was meant to be the first of the series of ten yachts ordered by Polish Maritime and Colonial League. She was built after the Swedish sail-training yacht “Kaparen”: the ship was 25.4m long, had 5.9m beam and 3.4m draft, displacement of 105t and 309m² sail area and could accommodate 30 crew members. Two auxiliary engines were installed.

1. LITERATURE REVIEW

The yacht came to Poland after the war, in 1946. She has been in service under a few names: first as “General Zaruski”, then (in 1956) as “Młoda Gwardia” and, a year later, as “Mariusz Zaruski”. In 1969, the original name was restored. The vessel has been used intensively for 57 years and underwent a series of serious modernizations in 1958, 1962, 1976 and 1978-82 during which the engines have been replaced a few times, what caused a serious changes to the vessel’s interior and structure. The living areas in the bow and stern part were separated by a large engine room and the steel bulkhead with watertight doors was placed amidships. New, larger deckhouses were fitted as well, irrespectively of the original profile of the yacht. The yacht’s operation ended in 2003 when her Class Certificate was lost due to the bad technical condition.

The situation changed in 2008 when “General Zaruski” was bought by the City of Gdańsk. The new owner planned to revitalize the yacht with respect to two contrary requirements. The first was to restore the original, traditional architecture on the basis of the design documentation of “Młoda Gwardia” and (especially in case of the interior) “Kaparen”. The second was to provide a proper living standard for both the professional crew and the trainees – an essential thing if one wants to offer a modern sail-training program. According to the owner’s detailed guidelines the vessel after the restoration should have minimum 26 berths, 10-days autonomy and *yKM II class given by Polish Register of Shipping.

In the design process these guidelines took form of three basic constraints. With respect to space and function, the yacht’s interior had to be reintegrated by reducing the size of the engine compartment and by locating it under the amidships rooms’ floors. With regard of aesthetics, the original deckhouses had to be rebuilt. Regarding structure and technology, the vessel’s mass had to be limited and stability properties improved by replacing the old deck with a new lighter one and by designing tanks and interior ballast which better fit the bottom geometry.

Fulfilling these requirements would not be possible without frequent and precise coordination between structural and architectural design works. In this paper we draw conclusions about the relationship between the architecture and the structure of vessels based on the analysis of a real design process.

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Usually, the problem is described in literature as an issue of collaboration between the naval architect (a chief designer, an engineer) and the marine designer (an architect, a stylist). In “Aesthetic aspects of ship and yacht design” [2] J. Guiton points out that the first of them is responsible for the appearance of the boat. He stresses the word “architect” in the term “naval architect” and claims that the activity of ‘stylists’ is a mistake that results in the technical and aesthetic concepts of the vessel becoming disconnected.

On the other hand, 11 years before that, Witold Urbanowicz – one of the fathers of the Polish school of marine design – presented a different opinion: “Today shipbuilders have to use the specialist’s help – also with respect to space shaping, comfort and aesthetics – and this specialist is a marine designer, someone who has been taught how to apply architectural criteria to ship design.” [9] This issue was later expanded on in the second edition of his fundamental work “Ship Architecture” in the chapter “Limitations of collaboration between the naval architect and the marine designer”. [10]

According to A. Nazarov [6] a similar tendency may be observed in small craft design process. Thirty years ago yachts were designed solely by naval architects. Today – even in the case of small vessels – a team of different professionals with marine designers and even civil architects among them is involved in the project. Consequently, we experience a growing importance of multi-professional collaboration resulting from the increase in the technical complexity of crafts as well as the rising demands of the clients.

In the field of yacht design architectural aspects were clearly pointed out by a Polish yacht designer Zbigniew Milewski, who wrote: “The issue of interior form and layout which should allow the separation of zones of different functions is a basic problem. […] The important thing is to combine the functional and the aesthetical features of the interior and the exterior of a boat. It means that we are entering – as we were in the case of the hull lines shaping – the field of architecture.” [5]

A view of the architect may be given by Andrzej Lerch who claimed: “A marine designer – as well as the civil architect – cannot ignore constraints of the ship structure in his or her creation. […] It applies to both exterior and interior shaping.” [4] And in “Ship Architecture – design and structural issues” edited by Maria Stawicka-Wałkowska [7], the role of marine designer is emphasized due to his or her responsibility for the safety of vessel usage.

2. THE RECONSTRUCTION DESIGN PROCESS

To close the review of literature it must be said that all authors agree to see the naval architect as a leader of the team of specialists – on the basis of which it may be concluded that structural and technical issues – not architectural ones – are the main determinants of watercraft design process.

“General Zaruski” reconstruction is a specific case because the project idea was to give the old hull and deckhouses a new functional program. Therefore the following analysis concerns only the relation between the structure and interior architecture of the vessel. The study was based on the preserved documentation as well as on the new preliminary, concept and classification designs of reconstruction. Selected examples of certain relations were analyzed using a case study method. The kind and strength of the relationships were shown in each case.

In the first case – the general arrangement design phase – interaction between the architectural and structural aspects is simple and one-way. Interior architecture is directly subordinate to the form, dimensions and material of the structure as well as to location of such elements as masts, engine shafts and the rudder shaft. Shaping structural elements according to architectural requirements – as it happens in the design of a new vessel – was not possible.

In the technical design phase further structural constraints of traditional wooden technology emerged. Large – when compared to more modern materials – dimensions of wooden framing reaching the height of 170mm for frames and 90mm for deck beams and thick plating – 60mm for the hull and 50mm for the deck – significantly limited the interior volume. These constraints are noticeable especially in the stern cabins where the clear height is only 175cm – as well as in the trainees’ quarters where berths’ vertical clearance is below today’s norm.
Providing an interior design with 26 berths (where at least three are in cabins) in these circumstances would not be possible without changing the original layout known from “Kaparen” and “Młoda Gwardia”. Therefore, the engine compartment was minimized and lowered and the main companionway was moved back from the trainees’ quarters. It allowed to create the new amidships consisting of two crew cabins and a corridor that joins the officers’ mess room and the trainees’ quarters and has a separate deck exit through the new, shorter companionway. Thanks to these modifications, the original bow-to-stern passage under the deck was restored and the comfort in the trainees’ space increased, as it is now separated from outside with one more door. Implementing these serious architectural changes had to influence the structure. The new deck design was made, in which the gangway and the skylight perforations were transposed.

Fig. 1. „General Zaruski”. Transverse section through the galley and trainees quarters. Steel step shaped deck of the galley as well as large dimensions of wooden structure are visible.

Another significant change in the original ship caused by architectural requirements was implemented in the galley deck structure. On “Kaparen” the galley deckhouse was lowered below the main deck level for better forward visibility and for aesthetics reasons. This – together with wooden floor and its wooden support of large dimensions – yielded poor clearance of 1.5m under the galley where the corridor from the trainees’ quarters to the forecastle was located. In the new interior design a change in crew circulation scheme was proposed: instead of one corridor in the centerline two corridors on both sides and a corpus with crew lockers in the centerline were shaped. The galley deck was given a step shape section (lower in the middle, over the corpus and higher on the sides, over the corridors). This idea allowed us to place berths on both sides of the front part of the trainees’ quarters as well as in the rear part, but new structural solutions became necessary. To keep the galley deck rigid but minimize its dimensions it was designed as a “bathtub” of 4mm thick 316L stainless steel. Transverse stiffeners in average span of 365mm were given a 35x35x4mm L-profile. The structure is
joined with the deck with M12 bolts and lays on two pillars made of 60x60x5mm tubes standing on the keel on frames no. 24 and 26.

Interior architecture affected yacht structure in a few more cases. New fresh water and waste water tanks were placed in the bilge, not in the living area as they were before. The collision bulkhead was moved forward to gain space for the trainees’ bathrooms. The deck pillars were located with respect to the architectural space divisions.

The last case of the study concerns the technology and the appearance of the deck and the ceilings. Typical plywood or laminate ceilings were found very difficult to design in a satisfactory way as they limit room height, increase the vessel’s mass, handicap ventilation, increase building costs and impede future deck repairs. Thanks to traditional technique of deck building in which deck planks are nailed directly to the deck beams it was possible to use its bottom part “as a ceiling”.

Therefore – taking advantage of insulating features of wood – simple uncovered wooden deck without suspended ceiling was proposed as a solution. In this case, despite achieving technical and budget objectives, important architectural aims were reached. Interiors gained a new, attractive – very appropriate for sail-training – nearly ascetic expression of crude wooden structure. Rooms seem to be bigger not only because of larger height but also – apparently – thanks to the inclusion of the space between deck beams and the white color of the whole. This is a clear example of how the shipbuilding technology can directly influence the architecture of the vessel.

CONCLUSIONS

The analyzed case of “General Zaruski” reconstruction project shows clear relationship between the architecture and the structure of the yacht. These dependencies are strong because of four main reasons: relatively small dimensions of the craft, wind propulsion constraints, historical heritage to be preserved and the characteristics of the wooden structure. In case of restoration of a traditional ship the new function follows the historical form, and also the historical technology. This is why the structure impacts the architecture more than the other way round. Nevertheless, thanks to the close collaboration of the naval architect and the designer, this relationship may be recognized and used for creating a rewarding design in its all structural, functional and aesthetic aspects.

In every successful work of human activity artistic and technical issues blend in together in a harmonious whole. As the avant-garde architect Le Corbusier, fascinated with ocean liners of the 20th century, wrote, in case of a ship, this harmony is “[…] the result of work governed by economy and conditioned by physical necessities. This harmony had its causes; it is not in any way the effect of caprice, but is of a logical construction […]”.[3]

Abstract

The article analyzes the relationship between the architecture and the structure of a vessel on the example of the reconstruction design of the wooden sailing yacht “General Zaruski” built in Ekanäs, Sweden, in 1939. The case study was based on the documentation of “Kaparen” (sister yacht), “Młoda Gwardia” (ex “General Zaruski”) and the reconstruction classification project made by the authors. The impact of functional, spatial and aesthetic design objectives (e.g. interior integration, stability amendment, restoring the original exterior styling) on the yacht’s structure as well as influence of structural conditions (e.g. type and dimensions of the structure) on her architecture have been proved.

Analiza relacji między architekturą a konstrukcją statku na przykładzie procesu rewitalizacji historycznego Jachtu „General Zaruski” realizowanego w latach 2009 - 2012

Streszczenie

W artykule przeanalizowano związek między architekturą a konstrukcją statku na przykładzie projektu rewitalizacji drewnianego jachtu „General Zaruski” zbudowanego w Ekanäs w Szwecji w 1939 roku. Opracowanie zostało oparte na dokumentacji siostrzanego jachtu „Kaparen”, „Młoda Gwardia” (“dawny General Zaruski”) oraz projektu przebudowy, opracowanego przez autorów. Artykuł przedstawia wpływ funkcjonalnych, przestrzennych i estetycznych elementów projektu takich jak integracja wewnętrzna, zmiana stabilności, przywrócenie pierwotnej stylistyki zewnętrznej oraz wymiarów na warunki konstrukcyjne jachtu.
BIBLIOGRAPHY