

## CONCEPTUAL DESIGN AS THE PART OF DESIGNING PROCESS OF THE SPECIAL PURPOSE FLAT BOTTOM BOAT

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### 1. Conceptual design

Conceptual design has become essential in the successful implementation of construction projects in industrial plants. Companies remark, that the key decisions made early in the process of conceptual accelerate the engineering tasks and have tremendous impact on the performance of the entire plant. The most general definition of the design gives Patzak, [1] according to him: Design is a process that leads to human activities, from the initial state (from problem to solution - the need to meet) to the final state, which is the desired result (system = product, object, organization process, a computer program) that meets established requirements. In general, any design process in detail should be conducted and presented according to the type of intended system; technical, socio-technical, organizational, there will be differences in the elements of the design and implementation of a more or less important.

Conceptual design process usually consists of several steps:

- understanding the main problem together with the requirements,
- understanding the requirements
- identification and creation of a wide range of alternative solutions that involve problems and requirements of the source,
- evaluation of alternative solutions and combining the best features of each,
- determination which solutions require interaction with the engineering of the invention,
- selection of alternative combinations that best solve the root problem and meet certain

requirements, as well as business goals and constraints.

One of the first stages of the conceptual design process is to understand the problem and to define the requirements and restrictions. Determination of the initial assumptions is a key step in having a big impact on the final solution.

### 2. Design Concept

One of the conceptual design process was the design of the special purpose flat bottom boat carried out by a group of engineers and designers from Wrocław University of Technology together with the Academy of Arts and Design.

The aim of this project was to elaborate a design of the special purpose flat bottom boat, then build it and test it. The main assumptions were to design a boat that purpose can be easily changed and the boat can easily asses the coast and shallow areas.



Fig. 1. Design concept of the special purpose boat

Due to many functional and technical assumptions, taking the creativity into action the designer proposed a few solutions. After the selection process that took all requirements and assumptions into consideration the final design concept was selected, Fig 1. In the conceptual design stage of

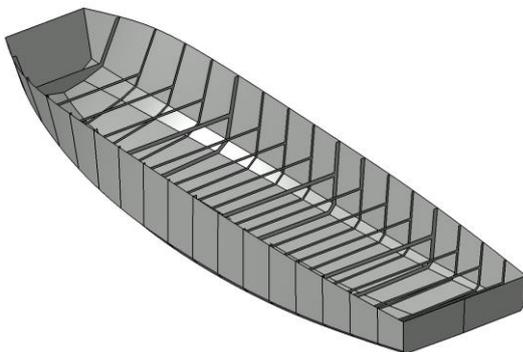
the boat, the brainstorming that takes features and actions to foster creativity was carried out. Generating ideas and their subsequent evaluation and development of selected, allowed an interdisciplinary group to receive the final solution. This allowed to create and develop solutions that increase the functionality of the boat. Fig. 2 presents one of the solutions, that is the opening system of the front door.



**Fig. 2.** Concept design with the opening system of front door

### 3. Implementation of the design concept

In the next step of the design process the selected concept moves into the implementation – realization. This demands designing of the boat structure, technological processes, functional mechanics, and complete design of buoyancy of the boat. Due to this fact the complete virtual model of the boat was build. Fig 3 presents the 3D geometrical model of the hull together with frames for conducting the computer simulations in accordance of boat building requirements.



**Fig. 3.** 3D virtual model with the frames of the hull

The process of mechanical design of the boat consist the building the geometrical model, computational model and final 3D documentation. This allows to correctly design the complete structure of the boat together with the technological processes. The computational model

is used to perform the numerical simulation with the use of Finite Element Method [2].

Performing the computer simulations allows to determine the strength of the boat structure as well as to calculate the correct boat buoyancy. In the next step the prototype of the boat will be build. All performed simulations will be validated in the elaborated testing done on the prototype.

The final view of the boat design shows the visualization of the boat in real condition and the type of the purpose and equipment, Fig 4.



**Fig. 4.** Final view of the boat design

### 4. Remarks

Performed conceptual design process of the special purpose flat bottom boat shows how important is the first stage (designing of a concept and computer simulations) in the verification of the design assumptions and regulations. Used techniques to stimulate creativity as the proper brainstorming and validation of the project allowed the design group to obtain the final concept of innovative solutions. The development of techniques for enhancing creativity among designers is one of the key tasks of the conceptual design process allows to obtain new solutions.

### Acknowledgements

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