

Review of the Main Stages of Developing Hydru Car for Participation in Shell Eco Marathon

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Abstract: The paper presents the conceptual idea of University of Ruse team for creating a prototype of an urban car driven by hydrogen fuel cell energy. Shown are the steps and development stages. A special accent was put on the design of the car. Presented is the connection between the different car systems and elements of the two car prototypes R1 and R2 created by now for the participation in the international competition Shell Eco Marathon.

Keywords: transport, urban concept vehicle, electric vehicle, hydrogen, design

INTRODUCTION

The creation of the Hydru car goes through different stages that aim at building a real model based on the initial ideas outlined in the sketches. The complexity of the entire procedure was how to select the most appropriate materials and technologies in order to implement the project in time.

The purpose of this article is to briefly illustrate the steps the car development has gone through. They highlight the main problems the team face until succeeding to achieve its original design.

The biggest achievement comes from the fact that despite the short deadlines, the team managed to create two versions of the car. With the first R-01, the team participated in the Shell celebrations in Sofia, and three months later, the R-02 version was created. It is lighter in terms of weight, has paid more attention to details, participated in the Shell eco marathon in Istanbul and won the prize for best design.

PROJECT TIMELINE

After the initial presentation of the vehicle concept designs, few of them were selected for further development. Some of the models were also rendered and sketched using specialized software products (Fig. 1, Fig. 2).

With a clear concept in mind, the HydrU race team members proceeded to the stage of prototyping the first version of the vehicle. As the shape of the car is extremely complex was chosen a modelling method that uses projection of the vertical sections of the vehicle on Expanded polystyrene hard foam (XPS). A total of 52 vertical sections were made and after their projection on the XPS, they were cut, glued together and smoothen (Fig. 3).

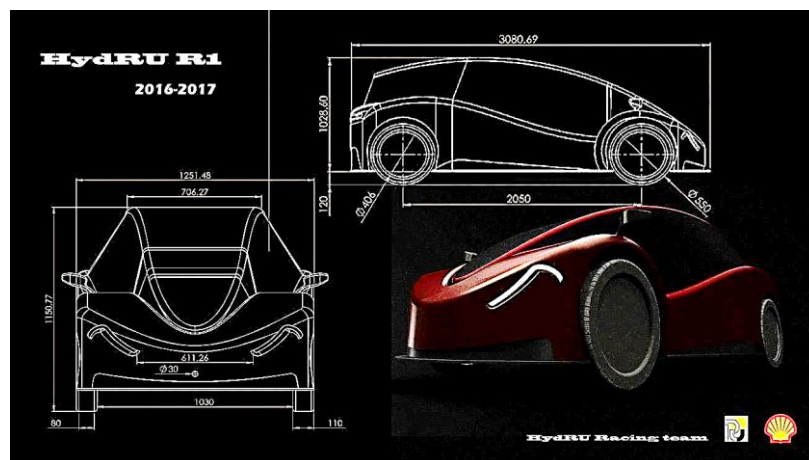


Fig. 1 Based on the 3D computer designed models, a hybrid design was chosen, so that the advantages of all concepts are kept, but their disadvantages are reduced as much as possible



Fig. 2 Rendered models of car



Fig. 3 Different stages of the modelling using the vertical sections of the car made from XPS

With the model ready we have proceeded with the softening of the vehicle surfaces and application of isolation materials, so that resin can be applied without damaging the XPS model (Fig. 4).



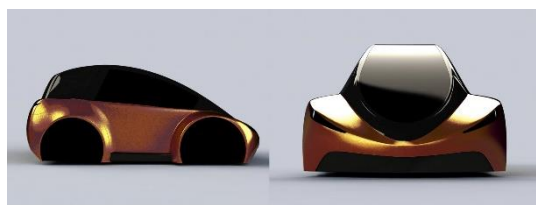
Fig. 4 The team after the sanding of the vehicle model and the car after the isolation material was applied

After the preparation of the vehicle for the next stage, the car model was covered by layers of resin and fiber cloth (Fig. 5).



Fig. 5 Part of the team while applying layers of resin and fibre cloth to the vehicle model. Due to the specifics of the process and the requirement for the drying of the resin, we had to work even till very late in the night

When all of the layers of resin and fibre cloth were applied, the imperfections were resolved using fine polyester filler and sanding of all surfaces. The XPS model was then removed and the final rough and unpainted body of the vehicle was completed. The next step of the process involved the generation of different color patterns for the car painting. Several different versions were proposed (Fig. 6) and all team members had to vote for their best choice. The final version of the first prototype was selected to be painted in solid white color (Fig.7). This model was named R01 and was presented to the mass media and to the general public during an event called “10 years of Bulgarian participation in Shell eco marathon”.



1080-M22 Matte Deep Black/Satin Rising Sun Gold



1080-M22 Matte Deep Black/Satin Urban Jungle Silver Green



Gold Orange Pearlescent/1080-M10 Matte White
 1080-M22 Matte Deep Black

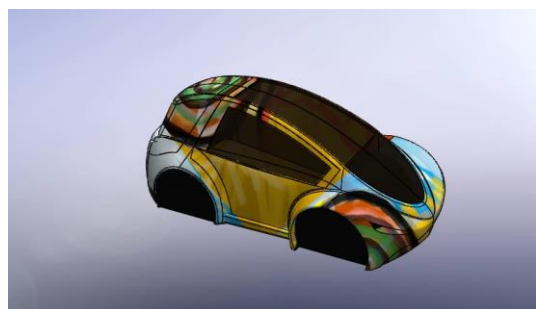


Fig. 6 Some of the color combinations, which were proposed for the vehicle painting



Fig. 7 The final version of the first version of the vehicle (Model R01).

The whole car was painted in white

After our participation in the event, was taken the decision to modify the initial

prototype of the vehicle in order to reduce its weight and to make some of the components detachable. As a result almost the entire prototype was cut into pieces, which were thinned out and used to make moulds and cast the new components of the vehicle body (Fig. 8).



Fig. 8 The initial prototype of the vehicle was cut and the parts were used to make moulds and cast the new body components

The final vehicle frame and all of the body components were painted according to the choice of the team members (Fig. 9).



Fig. 9 Moments from the painting of the vehicle frame and body components

CONCLUSIONS

The entire vehicle design and construction was a long, but fruitful process for the entire team. For the 12 months from the first kick-off meeting till the Shell Eco Marathon Challenge in Turkey we have learnt many new things and we have managed to improve significantly our skills. We have formed new friendships and by presenting the car we have attracted attention on a regional and national level. In a year we have managed to make not 1, but two versions of our car. Model R01 was a vital part of the design process, but Model R02 has turned into a real marble. Its convertible design and the different configuration present us with a modern looking and flexible single seat urban vehicle.



Fig. 10 The team with Model R02 during the presentation of the car in front of the main university building in Ruse, Bulgaria

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