The Formula SAE challenges university students to design and manufacture a marketable vehicle for racing. The Technion Team consists of several subgroups who, together, designed and built this vehicle.

The Aerodynamics Team of the Technion Formula conducted comprehensive research of the undertray and wings of the car for preliminary modeling. Original design, manufacturability, maintenance and system integration were essential elements of the design.

The Technion Formula Team’s objective is to design, manufacture, market and race a vehicle according to the Formula SAE guidelines. The Team objective is to design and manufacture an aerodynamic package consisting of an undertray and front and back wings:

The Aerodynamics Team had two primary objectives:
- The creation of maximum down force to improve cornering performance.
- Maintaining aerodynamic stability for good handling.

**Abstract**

**Project Objective and Requirements**

The Technion Formula Team’s objective is to design, manufacture, market and race a vehicle according to the Formula SAE guidelines. The Team objective is to design and manufacture an aerodynamic package consisting of an undertray and front and back wings:

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**Product Description**

**Basic requirements**
Two types of requirements determine the basic form and dimensions of the wings and undertray: Requirements set by the FSAE Technion Team and advisors. Some typical requirements:

**FSAE Regulations:**
- Sharp edges on the forward facing bodywork or other protruding components are prohibited.
- All wing edges including wings, end plates, Gurney flaps, wicker bills and undertray that could contact a pedestrian must have a minimum radius of 3.5 mm

**Technion FSAE Team’s Requirements:**
- High levels of total Downforce (\( > 100 \text{ Kgf} \) @ 80 km/h).
- Total weight of the undertray and wings should be lower than last year.

To create a product answering all the requirements the following steps were taken:
- Consulting with specialists in following fields: aerodynamics and design of cars, composite materials; tool production; etc.
- Experiments to determine material strength and strain.

**Analysis and Production**

**Flow and Strength Analysis**
During the design process, CFD analysis was performed to determine the aerodynamic properties. Simplified FEA strength analysis was performed, and the final material configuration was chosen with the aid of professional engineers from the industry.

**Figure 1:** CFD results, multi element front wing-nose assembly

**Tools and body manufacture**
The wings and undertray were manufactured from carbon-fiber. The manufacturing process involved the following steps: 3D modeling of the tools for the final product; machining and joining molds made from Polystyrene and MDF, shaping with a CNC machine (see Figure 3); finishing and polishing the molds; lay up of the carbon fibers (see Figure 4); vacuum bagging of the final parts (see Figure 5).

**Figure 2:** Strength analysis of the back and front wing insert.

**Manufacturing Process**

**Machining & joining mold parts made of polystyrene**

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