**Aerodynamics and Body Team**

**Product Design Course**

**Client:** Nimrod Meller  
**Team leader:** Michael Kootzenko  
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**Advisor:** Jeffrey Meyer

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**Abstract**

The team is responsible to design and manufacture the vehicle’s body, seat and wings. The aerodynamic design of the wings was done by Yair and Alon, the strength analysis of the wings and the design of the connection to the chassis by Adir, the seat by Benjamin and the undertray by Roy. The whole team took part in manufacturing the parts.

**Wings**

**Main requirements:**
- Total weight of 12 kg.
- Down force of 110 kgf – driving speed of 80 km/h
- Complying with FSAE regulations

**Achievements:**
- Total weight of 9.8 kg.
- Down force of 155 kgf – driving speed of 80 km/h

**Wings – Aerodynamics**

**Analysis:**
The wing profile elements were chosen to be S1223 based on XFoil and CFD (2D) analysis. The wings are twin-element design for both, front and rear.

**Front wing Configuration:**
- Distance from the ground: 151 mm
- Chord line for both elements: 260 mm
- Lift coefficient: 4.15 ; Drag coefficient: 0.08
- First Element – angle of attack (AOA) of -7 degrees.
- Second Element – angle of attack (AOA) of -16 degrees, adjustable up to -24 degrees.

**Rear wing Configuration:**
- Chord line first element: 550 mm
- Chord line second element: 220 mm
- Lift coefficient: -3.12 ; Drag coefficient: 0.07
- First Element – angle of attack (AOA) of -10 degrees.
- Second Element – angle of attack (AOA) of -35 degrees.

The size of the wings’ elements was chosen to achieve moment balance around the aerodynamic center.

**Wings – Design**

The rear and the front wings were designed with the ability to be disassembled. The front wing is connected directly to the body by screws. The rear wing is connected to the chassis using 6 bars, 3 of different lengths, 2 of each length – this structure can handle bending and side forces and easy to manufacture.

**Seat**

**Main requirements:**
- Lighter seat compared to last year
- Ergonomic seat – complies with the FSAE regulations

**Achievements:**
The seats weight 1.2 kg (3.2 kg last year). It can withstand load of 90.7 kg and the headrest is easily adjustable. The seat is lying down position, ergonomic and fits to variety of drivers’ weight or size.

**Undertray**

**Main requirements:**
- Lighter undertray compared to last year
- Better flow analysis and forces calculation
- Complying with FSAE regulations

**Achievements:**
The undertray’s weight 6.1 kg (9.5 kg last year). The flow analysis was made under the assumptions of 1D compressible flow within the diffuser tunnels.

**Wings – Inserts Strength Analysis**

**Manufacturing Process**

- Machining by CNC & combining mold parts made of polystyrene
- Laying up of carbon fiber layers
- Vacuum bagging
- Manufactured part pre-paint

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